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AUSTRALIAS OIL SECURITY AMID INDO-PACIFIC GEOPOLITICAL UNCERTAINTY

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by

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Australia's heavy reliance on oil imported from the Middle East and Asia via high-risk oceanic shipping routes undermines its oil security, particularly given the increasing tension between its ally the United States and China in the Indo-Pacific region. This thesis examines the Australian government's energy policies and ongoing oil development programs to answer the following questions: how does Australia try to ensure its oil security? And, in what ways will Australia's strategic partnerships help its efforts to improve its energy security? This thesis finds that the Australian government is increasingly involved in oil security: it has tried to strengthen its oil security by reducing its reliance on imported fuel sources. Nevertheless, this thesis concludes that despite Australia's current efforts, it is still at high risk of losing most of its imported oil supply in the event of direct conflict in the Indo-Pacific. This thesis further argues that Australia's current international cooperation and strategic partnerships in the energy sector do not directly contribute to strengthening Australia's oil security. Therefore, while continuing to increase domestic oil reserves and production and also decrease its oil consumption, Australia most importantly needs to diversify its oil supply regions, especially to areas where oil supply lines are not threatened by direct conflict between the United States and China.

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AUSTRALIA'S OIL SECURITY AMID INDO-PACIFIC GEOPOLITICAL UNCERTAINTY

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ABSTRACT

Australia's heavy reliance on oil imported from the Middle East and Asia via high-risk oceanic shipping routes undermines its oil security, particularly given the increasing tension between its ally the United States and China in the Indo-Pacific region. This thesis examines the Australian government's energy policies and ongoing oil development programs to answer the following questions: how does Australia try to ensure its oil security? And, in what ways will Australia's strategic partnerships help its efforts to improve its energy security? This thesis finds that the Australian government is increasingly involved in oil security: it has tried to strengthen its oil security by reducing its reliance on imported fuel sources. Nevertheless, this thesis concludes that despite Australia's current efforts, it is still at high risk of losing most of its imported oil supply in the event of direct conflict in the Indo-Pacific. This thesis further argues that Australia's current international cooperation and strategic partnerships in the energy sector do not directly contribute to strengthening Australia's oil security. Therefore, while continuing to increase domestic oil reserves and production and also decrease its oil consumption, Australia most importantly needs to diversify its oil supply regions, especially to areas where oil supply lines are not threatened by direct conflict between the United States and China.

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TABLE OF CONTENTS

LIST OF FIGURES

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LIST OF TABLES

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LIST OF ACRONYMS AND ABBREVIATIONS

A2/AD	anti-access/area-denial
ACT	Australian Capital Territory
ADIZ	air defense identification zone
ADWP	Australian Defense White Paper
AERA	Australian Energy Resources Assessment
ANZUS	Australia, New Zealand, and the United States
AREH	Asian Renewable Energy Hub
ARENA	Australian Renewable Energy Agency
ASPI	Australia Strategic Policy Institute
AUSMIN	Australia–US Ministerial Consultations
BEV	battery electric vehicle
BITRE	Bureau of Infrastructure, Transport and Regional Economics
BRI	Belt and Road Initiative
CEFC	Clean Energy Finance Corporation
CEO	Chief Executive Officer
CISRO	Commonwealth Scientific and Industrial Research Organisation
CO2	carbon dioxide
EV	electric vehicle
EWP	Energy White Paper
FCEV	Fuel Cell Electric Vehicle
FOIP	Free and Open Indo-Pacific
FPA	Force Posture Agreement
GDP	Gross Domestic Product
GISERA	Gas Industry Social and Environmental Research Alliance
GW	Gigawatts
HESC	Hydrogen Energy Supply Chain
HEV	Non-Plug-in Hybrid Electric Vehicle
IBE	Infinite Blue Energy
ICE	Internal Combustion Engine
IEA	International Energy Agency

LNG	Liquefied Natural Gas
ML	Million Liters
NEPP	National Energy Productivity Plan
NESA	National Energy Security Assessment
NRMA	National Roads and Motorists' Association
NSS	National Security Strategy
OEC	Observatory of Economic Complexity
OECD	Organization for Economic Cooperation and Development
PHEV	Plug-in Hybrid Electric Vehicle
RFI	Request for Information
SCS	South China Sea
SLOC	Sea Lines of Communication
SMR	Steam Methane Reforming
SPR	Strategic Petroleum Reserve
SUV	Sport Utility Vehicle
U.S.	The United States
USINDOPACOM	United States Indo-Pacific Command
USPACOM	United States Pacific Command

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I. INTRODUCTION

A. MAJOR RESEARCH QUESTION

Australia is endowed with an abundance of natural resources, such as hydrocarbon, uranium, and renewable energy. Given those resources, Australia has consistently been ranked among the top ten countries for energy security from 1980 through 2016, according to the Global Energy Institute of the U.S. Chamber of Commerce.[1] This ranking means Australia is very strong in energy sustainability, resilience, and affordability. The energy sector can fulfill the Australian consumers' demands, notably for electricity and petroleum.

Nevertheless, while relatively self-sufficient in several types of energy, Australia finds itself increasingly reliant on oil imports from the Middle East and Asia. In fact, Australia's energy oil-security is 90 percent reliant on imports primarily from the Middle East and Asia for its domestic consumption.[2] With the new geopolitical development of the Indo-Pacific and the high risk of maritime security on its oil import routes, the changing geopolitics in the region will have significant implications for the country. Realizing this uncertainty and high tension in Australia's oil routes, in February 2018, the Australia-U.S. Energy Strategic Partnership Agreement in the Indo-Pacific was created.[3] Against the background just described, this thesis seeks to answer the following questions:

- How does Australia try to ensure its oil security, especially with its vulnerability to oil supply disruptions due to the uncertainty of maritime security?
- In what ways will Australia's strategic partnership assist in its quest for improved energy security?

[1] Global Energy Institute of the U.S. Chamber of Commerce, *International Index of Energy Security Risk: Assessing Risk in a Global Energy Market* (Washington, DC: U.S. Chamber of Commerce, 2018), 10, https://www.globalenergyinstitute.org/sites/default/files/2019-10/Final2018Index.pdf.

[2] John Blackburn, *Australia's Liquid Fuel Security Part 2: A Report for NRMA Motoring & Services* (Sydney, Australia: NRMA Motoring & Services, 2014), 5, https://permaculturenoosa.com.au/wp-content/uploads/2018/05/NRMA-Fuel-Security-Report-Pt2.pdf.

[3] Clara Gillispie, "U.S.-Australia Energy Cooperation in the Indo-Pacific," The National Bureau of Asian Research, last modified January 10, 2020, https://www.nbr.org/publication/u-s-australia-energy-cooperation-in-the-indo-pacific/.

B. SIGNIFICANCE OF THE RESEARCH QUESTION

Australia has grown as the middle power in Southeast Asia and has an essential political role in this region. Australia has enjoyed stable economic growth since the early 18th century thanks to many supporting factors. One of the most important factors is its abundant energy resources. The energy sector underpins Australia's economic development by enabling the country to meet the needs of its household or business sectors. Today, Australia has become an industrialized country with great energy consumers. According to the *Australian Energy Update 2019*, Australian energy consumption reaches 6,171.7 petajoules,[4] 94 percent of which is the consumption of fossil fuels (oil, coal, gas)[5] and renewable energy. Fuel oil has an essential role in supporting Australia's achievements that are contributing to 38 percent of Australian total energy consumption,[6] primarily for transportation, industry, and mining. In the period between 2010 and 2015, Australia lost its three refineries due to what the *Liquid Fuel Security Review Interim Report* said was, "a result of surplus refining capacity in the Asian region as demand fell after the Global Financial Crisis and a strong Australian dollar during the mining boom, which impacted on profitability."[7] Since then, Australia has relied on oil import products up to 90 percent. Even though Australia could have overcome the disruption of its oil supply in the past, the new geopolitics of the Indo-Pacific has brought unprecedented challenges to its oil security supply routes.

The rise of China creates political problems for the Indo-Pacific region. China's rapid economic growth, the expansion of its military, and its belligerent behavior attracts much attention from the world, chiefly the United States. Since 2009, China's behavior,

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[4] Australian Government Department of the Environment and Energy, *Australian Energy Update 2019* (Canberra, ACT: Australian Government Department of the Environment and Energy, 2019), 8, https://www.energy.gov.au/sites/default/files/australian_energy_statistics_2019_energy_update_report_september.pdf.

[5] Australian Government Department of the Environment and Energy, 8.

[6] Australian Government Department of the Environment and Energy, 9.

[7] Australian Government Department of the Environment and Energy, *Liquid Fuel Security Review: Interim Report* (Canberra, ACT: Australian Government Department of the Environment and Energy, 2019), 27, https://www.environment.gov.au/system/files/consultations/7cf6f8e2-fef0-479e-b2dd-3c1d87efb637/files/liquid-fuel-security-review-interim-report.pdf.

according to David Arase, "convinced the United States that China is a revisionist power seeking to impose an authoritarian model of governance in Asia which, if successful, would end the rules-based order in the Indo-Pacific as well as endanger U.S. security and vital trade interests"[8] The military activities, incidents, and tension, especially in the South China Sea, have increased in recent years. The introduction of the U.S. Free and Open Indo-Pacific (FOIP) concept in 2017 was followed by a quadrilateral strategic dialogue consisting of the United States, Japan, India, and Australia that tried to enforce rules-based order in this region,[9] which could lead to military conflict in the future. As an ally of the United States, Australia has a significant interest in the stability of the Indo-Pacific region, particularly the security of its sea lanes. The energy security, especially the sustainability of Australia's oil supply, affects the developments and capability of the country to fulfill its national interest. The measures taken by the Australian government to provide for its oil needs under the uncertainty of maritime security in the Indo-Pacific region will be useful for other countries in this region and will support its oil dependency policy. Australia's measures are also critical to ensure Australia's sustainability in supporting the United States if conflict erupts in the region. That is why it is crucial to understand Australia's preventive actions enabling it to overcome its oil security dependency in the event of military conflict in the Indo-Pacific region.

C. LITERATURE REVIEW

This section reviews the relevant literature necessary to provide an accurate overview of the Australian energy security framework and conceptual policy. Three main areas of research that contribute to this thesis are: the definition of Australian energy security, the description geopolitical dynamic in the Indo-Pacific region, and a survey of the literature on Australia's oil security. Defining Australia's energy security facilitates an understanding of the objectives that should be achieved to support Australia's national interests. Furthermore, this literature review explains the geopolitical environment

[8] David Arase, *Free and Open Indo-Pacific Strategy Outlook*, Trends in Southeast Asia, No. 12 (Singapore: ISEAS Publishing, September 2019).

[9] Donald E. Weatherbee, "Indonesia, ASEAN, and the Indo-Pacific Cooperation Concept," *Perspective* 2019, no. 47 (June 7, 2019): 2.

situation that will affect the way the Australian government executes any policy action to fulfill these goals. Finally, after examining both of the aforementioned areas, the literature's last part discusses Australia's energy reports and previous research, which provides a body of knowledge concerning any issue that has been assessed or will be assessed regarding Australia's energy security within the context of the dynamic situation in Indo-Pacific maritime security.

1. Defining Australia Energy Security

Energy security has become a popular subject for many scholars, who define it in various ways. The relevance of this topic emerged on the eve of World War I, when Winston Churchill decided to switch royal navy ship propulsion from coal to oil in order to get speed advantages over the German Navy.[10] The basic understanding of energy security in the Churchill example is purely limited to securing the oil supply. Since then, the focus and definition of energy security has evolved and expanded. The authors of energy security literature emphasize the different dimensions that affect their understanding of the topic. According to Daniel Yergin, energy security is broadly defined as "the availability of sufficient supplies at reasonable prices."[11] Similarly, the International Energy Agency (IEA) states that energy security is "the uninterrupted availability of energy sources at an affordable price," which encompasses investments in supporting economic growth needs for the long term and in the short term covers the appropriate responses to sudden supply-demand fluctuation.[12] These authors highlight the economic sector as the basis of their basic energy security definition. Other scholars, like Benjamin K. Sovacool et al., define energy security in a broader view, considering several related dimensions. They argue energy security is "how to equitably provide available,

[10] Daniel Yergin, "Ensuring Energy Security," *Foreign Affairs* 85, no. 2 (April 2006): 1, ProQuest.

[11] Yergin, 2.

[12] "Energy Security: Reliable, Affordable Access to All Fuels and Energy Sources," International Energy Agency, accessed April 17, 2020, https://www.iea.org/topics/energy-security.

affordable, reliable, efficient, environmentally benign, proactively governed and socially acceptable energy services to end-users."[13]

The latest research by B. W. Ang, W. L. Choong, and T. S. Ng shows that in the period between 2001 and 2014, 104 studies in energy security generated 83 different definitions for the concept.[14] From those definitions, the authors identify the "seven major energy security themes or dimensions: Energy availability, infrastructure, energy prices, societal effects, environment, governance, and energy efficiency."[15] The result was that by categorizing the research based on period, type of sources from official reports and journals, and looking at qualitative and quantitative literature, the dominant themes are energy availability, infrastructure, and energy prices (see Figure 1).[16] For those periods, the scholars base their definition on those three themes and then followed with environment, social effects, government, and efficiency.

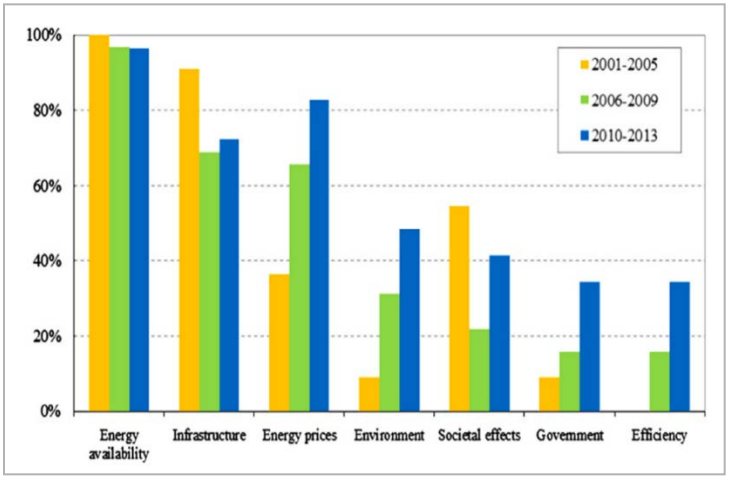

Figure 1. Scholarly coverage of each energy security theme in energy security definitions by time period.[17]

[13] Benjamin K. Sovacool et al., "Evaluating Energy Security Performance from 1990 to 2010 for Eighteen Countries," *Energy* 36, no. 10 (October 2011): 5846, https://doi.org/10.1016/j.energy.2011.08.040.

[14] B. W. Ang, W. L. Choong, and T. S. Ng, "Energy Security: Definitions, Dimensions and Indexes," *Renewable and Sustainable Energy Reviews* 42 (February 2015): 1078, https://doi.org/10.1016/j.rser.2014.10.064.

[15] Ang, Choong, and Ng, 1081.

[16] Ang, Choong, and Ng, 1083.

[17] Source: Ang, Choong, and Ng, 1083.

Ang et al. explain further that the energy availability theme covers the supply sources diversification and geopolitical factors "such as outbreaks of wars, destabilized regimes, or regional tensions which can lead to oil or gas supply disruptions."[18] Secondly, the theme of infrastructure includes facilities for energy transformation and transmission. Ang et al. further mention that the oil refineries, power plants, "pipelines, electricity transmission lines, sub-stations, and energy storage facilities" have to be available and maintained in adequate, robust, and good condition to support energy security supplies. The third dominant energy security theme is energy prices, which Ang et al. argue is "the affordability of energy supplies and has some dimensions such as the absolute price level, price volatility, and the degree of competition in energy markets."[19] Those themes, all or in part, can be found in the energy sector of official government documents of each country, as well as in the Australian government.

The Australian government defines energy security as a high-level condition in three major aspects, namely reliability, affordability, and resiliency of the country's total energy needs. This definition is clearly stated in a government document, the 2011 *National Energy Security Assessment* (NESA), which states: "energy security is defined as the adequate, reliable and competitive supply of energy to support the functioning of the economy and social development."[20] The first dimension is adequacy, which means that Australian energy is sufficiently available to support the needs of economic growth and its people's activities. The second term is reliability, which means the government can overcome an energy supply disruption with minimal effects on its people. Moreover, the last term is competitiveness, which means Australia can obtain the needed energy at affordable prices. NESA 2011 explains that, in this regard, energy competitiveness "does not adversely affect the competitiveness of the economy and that [it] supports continued investment in the energy sector."[21] These dimensions are interconnected with supporting

[18] Ang, Choong, and Ng, 1081.

[19] Ang, Choong, and Ng, 1082.

[20] Australian Government Department of Resources, Energy and Tourism, *National Energy Security Assessment 2011* (Canberra, ACT: Australian Government Department of Resources, Energy and Tourism, 2011), 2.

[21] Australian Government Department of Resources, Energy and Tourism, 2.

the Australian people's activities, which are mainly divided into energy types of electricity, fuels, and natural gas. Of these definitions, the Australian government only covers two of the seven general themes just discussed, energy availability and energy prices.

2. Uncertainty of Indo-Pacific Geopolitical Environment

The rise of China in the mid-20th century brought a new geopolitical term "Indo-Pacific" to the Asia region. In defining this term, C. Rajah Mohan explains "that the seas of the western Pacific and the Indian Ocean must be seen as a single integrated geopolitical theater, the 'Indo-Pacific.'"[22] The concept derives from the prime minister of Japan, Shinzo Abe, in his speech to the Indian Parliament in August 2007. Abe argued that "the Pacific and the Indian Oceans are now bringing about a dynamic coupling as seas of freedom and of prosperity. A 'broader Asia' that broke away geographical boundaries is now beginning to take on a distinct form."[23] Hence, he integrated the Indian Ocean and the Pacific Ocean, through which most global economic trading passes. The rapid economic growth of Asian countries, especially China and India, highlight the importance of the Indo-Pacific region for the interconnection of world development. The primary powers in Asia, the United States, Japan, Australia, and India, fear the rise of China can cause instability in the region. Furthermore, the term Indo-Pacific geopolitics, initiated by Japan and India, was soon adopted by Australia and the United States, and these countries promulgate the Indo-Pacific concept in order to manage China's rise. This aligns with what Chengxin Pan argues, that "fueled by their collective anxieties about China's growing influence in Asia, the 'Indo-Pacific' is not an innocent or neutral description, but is a manufactured super-region designed to hedge against a perceived Sino-centric regional order."[24]

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[22] C. Raja Mohan, *Samudra Manthan Sino-Indian Rivalry in the Indo-Pacific* (Washington, DC: Carnegie Endowment for International Peace, 2012), 212.

[23] "'Confluence of the Two Seas' Speech by H.E. Mr. Shinzo Abe, Prime Minister of Japan at the Parliament of the Republic of India," Ministry of Foreign Affairs of Japan, August 22, 2007, https://www.mofa.go.jp/region/asia-paci/pmv0708/speech-2.html.

[24] Chengxin Pan, "The 'Indo-Pacific' and Geopolitical Anxieties About China's Rise in the Asian Regional Order," *Australian Journal of International Affairs* 68, no. 4 (2014): 453, https://doi.org/10.1080/10357718.2014.884054.

China's rising power and economic might are perceived as a threat to regional stability and rule-based order in Asia. The emergence of China has challenged the United States as the main actor in providing stability and security in the Pacific and the Indian Ocean. China's remarkable economic growth, followed by its robust buildup of military capability, drives a new China foreign strategy approach. According to Mohan, China's rise necessitates a new approach to the importance of sea power as "an inevitable consequence of the enormously successful globalization of the Chinese and Indian economies in recent decades"[25] China uses its naval power projection capability in order to protect its Sea Lines of Communication (SLOC), economic interests, and other essential resources, and eventually, according to Mohan, China and India will "step on each other's toes and those of the Americans, the world's dominant maritime power."[26] The Chinese Navy will continue to check American dominance of the Indian and Pacific Oceans in the coming decades.[27] The powerful China military is likely to "create a more favorable security environment in its neighborhood" and push the United States far from its region.[28] China's assertiveness has generated a negative international perception that China poses a threat to international order and undermines regional stability. Among China's provocative actions are its establishment of the nine-dash lines that assert its unilateral claim of the South China Sea and the Senkaku/Diaoyu islands in the East China Sea; the establishment of an Air Defense Identification Zone (ADIZ) in the East China Sea; the creation of Spratly and Paracel islands for military bases; the implementation of a debt-trap diplomacy strategy; its investment in rogue regimes; and its restriction of freedom of navigation in the South China Sea.

The United States government takes China's rise seriously by addressing it in the U.S. national strategy policy. In 2011, the Obama administration switched the priority focus to the Asia region by promulgating "the pivot to Asia," or rebalance policy about

[25] Mohan, *Samudra Manthan Sino-Indian Rivalry in the Indo-Pacific*, 2.

[26] Mohan, 4.

[27] Mohan, 5.

[28] Stephen M. Walt, "Dealing with a Chinese Monroe Doctrine," *New York Times*, last modified August 26, 2013, https://www.nytimes.com/roomfordebate/2012/05/02/are-we-headed-for-a-cold-war-with-china/dealing-with-a-chinese-monroe-doctrine.

which the president said: "the United States is turning our attention to the vast potential of the Asia Pacific region."[29] This policy objective, he said, would "strengthen the United States' (U.S.) bilateral security alliances in Asia, intensify working relationships with regional states and the U.S., and boost regional trade and investment."[30] President Obama's rebalancing strategy shows, according to Khushboo Ejaz and Umbreen Javaid, that by containing China the "U.S. can grow its alliance in the Asia Pacific again and can engage properly."[31] One of the five underlying principles of this strategy is to increase military presence for maintaining security stability. The United States posts 60 percent of its naval and air force assets in the Pacific as of 2020.[32] The purpose is to counter the China Anti-Access/Area-Denial (A2/AD) strategy that according to the Missile Defense Advocacy organization can "disrupt freedom of navigation for the United States and the international community."[33] Security scholars Stephen Biddle and Ivan Oelrich, quoted in Charles Koch Institute, argue that China's A2/AD combines "a series of interrelated missile, sensor, guidance, and other technologies designed to deny freedom of movement" and to prevent intervenors from getting close to China's coast in order to launch an attack on China's mainland.[34]

[29] Barack Obama, "Remarks by President Obama to the Australian Parliament," The White House: President Barack Obama, last modified November 17, 2011, https://obamawhitehouse.archives.gov/the-press-office/2011/11/17/remarks-president-obama-australian-parliament.

[30] Laura Southgate, "The Asia Pivot as a Strategy of Foreign Policy: A Source of Peace or a Harbinger of Conflict?" (paper presented at the International Studies Association (ISA) Hong Kong Conference, University of Hong Kong, June 15, 2017), 2, http://web.isanet.org/Web/Conferences/HKU2017-s/Archive/d1c3ec10-7f24-4068-b08f-965aebc210a6.pdf.

[31] Khushboo Ejaz and Umbreen Javaid, "U.S. Indo Pacific Policy: Response of Regional States," *Journal of Political Studies;* 25, no. 2 (Winter 2018): 166.

[32] U.S. Department of Defense, *The Asia-Pacific Maritime Security Strategy: Achieving U.S. National Security Objectives in a Changing Environment* (Washington, DC: Department of Defense), 22, accessed April 18, 2020, https://dod.defense.gov/Portals/1/Documents/pubs/NDAA%20A-P_Maritime_SecuritY_Strategy-08142015-1300-FINALFORMAT.PDF.

[33] "China's Anti-Access Area Denial," Missile Defense Advocacy Alliance, accessed April 19, 2020, https://missiledefenseadvocacy.org/missile-threat-and-proliferation/todays-missile-threat/china-anti-access-area-denial-coming-soon/.

[34] "What Is A2/AD & Why Does It Matter to the US?," *Charles Koch Institute* (blog), accessed April 19, 2020, https://www.charleskochinstitute.org/blog/what-is-a2ad-and-why-does-it-matter-to-the-united-states/.

President Donald Trump's administration, from its start in January 2017, has continued to put the United States' attention on China's rise with all its assertive behaviors. Trump's leadership continues the Obama rebalance policy, but the current administration takes more significant and stronger actions in facing China. In 2017, he adopted the new Indo-Pacific geopolitical term, which had been used by Japan, India, and Australia. He officially mentioned this term as the free and open Indo-Pacific (FOIP) in the U.S. National Security Strategy (NSS).[35] The NSS clearly mentions that China tries to "displace the United States in the Indo-Pacific region, expand the reaches of its state-driven economic model, and reorder the region in its favor."[36] China's unfair political and economic behaviors "threaten the sovereignty of other nations, and undermine regional stability."[37] Vice President Mike Pence's remarks on the administration's policy towards China in October 2018 condemned and criticized China's economic and military aggression, which include stealing American intellectual property and attempting to intervene in the U.S. election.[38]

Following the NSS, Trump has taken a variety of actions that encompass military, political, and economic approaches. Early in 2018, he signed $716 billion to extend U.S. military dominance in every domain.[39] In May 2018, the U.S. Secretary of Defense James Mattis renamed U.S. Pacific Command (USPACOM) to U.S. Indo-pacific Command (USINDOPACOM).[40] Since then, the USINDOPACOM has been modernizing and expanding capacity to meet the National Defense Strategy that, according the Department of Defense, "directs the Department to ***posture ready, combat-credible forces forward—***

[35] Donald J. Trump, *National Security Strategy of the United States of America* (Washington, DC: The White House, 2017), 45, https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905-2.pdf.

[36] Trump, 25.

[37] Trump, 46.

[38] Mike Pence, "Vice President Mike Pence's Remarks on the Administration's Policy Towards China," Hudson Institute, last modified October 4, 2018, http://www.hudson.org/events/1610-vice-president-mike-pence-s-remarks-on-the-administration-s-policy-towards-china102018.

[39] Pence.

[40] Tara Copp, "INDOPACOM, It Is: U.S. Pacific Command Gets Renamed," DefenseNews, last modified May 30, 2018, https://www.militarytimes.com/news/your-military/2018/05/30/indo-pacom-it-is-pacific-command-gets-renamed/.

alongside allies and partners—and, if necessary, to fight and win."[41] The Trump administration emphasizes security cooperation and partnership among countries in the Indo-Pacific region.[42] The U.S. Secretary of State Mike Pompeo notes the United States has pledged US$300 million for new security cooperation, notably in maritime security.[43] Overall, the United States seeks to strengthen cooperation with its allies, namely Japan, the Republic of Korea, and Australia. As noted in Chapter I, the current administration has revived the quadrilateral strategic dialogue with Japan, Australia, and India, especially making India a counterbalance to China's power in Asia. In doing so, Trump maintains Barack Obama's view that India's role in Asia, according to Mohan, is "as part of an American effort to hedge against China's rise."[44] In the economic sector, Trump has imposed a series of tariffs on Chinese imports that have sparked a trade war. U.S. tariffs imposed on Chinese goods in March and July 2018, and in May 2019, totaled $284 billion and strained relations between the two countries.[45] China retaliated by imposing tariffs on American products. To contain China's economic influence in the region, in October 2018, Trump signed the Better Utilization of Investment Leading to Development (BUILD Act), which appropriates $60 billion to the Indo-Pacific region.[46] This reciprocal action has increased tension in the U.S.-China relationship that could lead to conflict.

Many scholars, in fact, argue that the great power competition in the Indo-Pacific region will likely lead to conflict. In his 2016 Naval Postgraduate School thesis, Jay J.

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[41] U.S. Department of Defense, *The Department of Defense Indo-Pacific Strategy Report: Preparedness, Partnerships, and Promoting a Networked Region* (Washington, DC: Department of Defense, 2019), 18.

[42] U.S. Department of Defense, 21.

[43] "U.S. Security Cooperation in the Indo-Pacific Region," U.S. Department of State, August 4, 2018, https://www.state.gov/u-s-security-cooperation-in-the-indo-pacific-region/.

[44] Mohan, *Samudra Manthan Sino-Indian Rivalry in the Indo-Pacific*, 10.

[45] "Timeline: U.S. Relations with China 1949–2020," Council on Foreign Relations, July 23, 2020, https://www.cfr.org/timeline/us-relations-china.

[46] "President Trump's Administration Is Advancing a Free and Open Indo-Pacific Through Investments and Partnerships in Economics, Security, and Governance," White House, November 18, 2018, https://www.whitehouse.gov/briefings-statements/president-trumps-administration-advancing-free-open-indo-pacific-investments-partnerships-economics-security-governance/.

English,[47] mentioned several scholars from several perspectives who have argued about the potential for conflict between the United States and China. A Chinese scholar, Ji Guoxin, stated that SLOC controls competition for the trading routes for regional and global resources and will lead the Asia-Pacific region to conflict. Practiced politician Aaron L. Friedberg, a former staff member of The White House, has argued from the realist's and pessimist's points of view that China is ambitious in achieving its national interests, even though those ambitions "challenge territorial boundaries, international institutional arrangements, and hierarchies of prestige that were put in place when they were relatively weak,"[48] and China will continue to behave assertively, which leads to inevitable conflict.[49] Similarly, according to the Global Trends 2030 report, a National Intelligence Council publication deduces that the lack of regional security cooperation in Asia will create the largest global threats due to fear of China and anxiety over U.S. involvement.[50] A political scientist, Inhan Kim, claims that there is a tendency for the United States and China to engage in a conflict due to the U.S. rebalance policy in Asia that triggers China to become aggressive.[51]

The Australian government acknowledges the evolving Indo-Pacific geopolitical uncertainty. Australia first used the term Indo-Pacific 58 times in the 2013 Australian Defense White Paper (2013 ADWP). This paper emphasized that the Indo-Pacific was emerging with strategic constructs that would continue to evolve, and as a consequence, "Australia's security environment will be significantly influenced."[52] With the rapid change in the Indo-Pacific environment, Australia restated the importance of the Indo-

[47] Jay C English, "Oil as a Weapon of the 21st Century: Energy Security and the U.S. Pivot to Asia-Pacific" (master's thesis, Naval Postgraduate School, 2016), https://calhoun.nps.edu/handle/10945/48515.

[48] Aaron L. Friedberg, "The Future of U.S.-China Relations: Is Conflict Inevitable?," *International Security* 30, no. 2 (2005): 19, https://www.jstor.org/stable/4137594.

[49] Friedberg, 20.

[50] National Intelligence Council (U.S.), ed., *Global Trends 2030: Alternative Worlds: A Publication of the National Intelligence Council* (Washington, DC: National Intelligence Council, 2012), ix.

[51] Kim Inhan, "More Rebalancing to Come: Progress and Prospects of the U.S. Rebalance to the Asia-Pacific," *The Korean Journal of Defense Analysis* 27, no. 3 (September 2015): 333.

[52] Australian Government Department of Defence, *2013 Defence White Paper* (Canberra, ACT: Australian Government Department of Defence, 2013), 7, http://www.defence.gov.au/whitepaper2013/docs/WP_2013_web.pdf.

Pacific environment for its national interests in its 2016 ADWP and followed it with the 2017 Australia Foreign Policy White Paper.

While the 2016 ADWP and 2017 Foreign Policy White Paper acknowledged that both cooperation and competition would color the U.S.-China relationship,[53] [54] during the G20 Summit in June 2019, Australian Prime Minister Morrison stated: "the world's most important bilateral relationship is strained: The balance between strategic engagement and strategic competition in the US-China relationship has shifted. This was inevitable." He argued "that this competition didn't have to become adversarial," but also it was "not inevitable that competition leads to conflict."[55] Aligning with the Australian prime minister, Linda Reynolds, Australia's Defense Minister, cites "a deepening sense of anxiety about the region's future," which she argues is a sign "that the sense of common purpose that has long driven economic liberalisation and tighter partnership in our region can no longer be taken for granted."[56]

Australia has also acknowledged China's rising power, and that China's huge military modernization has become a major concern in terms of the Indo-Pacific regional stability. The maritime territorial disputes in the South China Sea and the East China Sea have created uncertainty and tension. The 2016 ADWP predicted this uncertainty would intensify in the next two decades due to "the changes in the distribution of power in the Indo-Pacific and globally" and "the modernisation of regional military capabilities."[57] The same document then stated that Australia reshapes its military strength based on the level of anxiety in the Indo-Pacific environment and by raising its defense budget to two percent

[53] Australian Government Department of Defence, *2016 Defence White Paper* (Canberra, ACT: Australian Government Department of Defence, 2016), 40, https://defence.gov.au/WhitePaper/Docs/2016-Defence-White-Paper.pdf.

[54] Malcolm Turnbull, *2017 Foreign Policy White Paper* (Barton, ACT: Australian Government, 2017), 45, https://www.dfat.gov.au/sites/default/files/2017-foreign-policy-white-paper.pdf.

[55] Graeme Dobell, "Australia-US/East Asia Relations Scott Morrison, Donald Trump, and The Indo-Pacific," *Comparative Connections: A Triannual E-Journal on East Asian Bilateral Realtions* 21, no. 2 (September 2019): 127.

[56] Linda Reynolds, "Australia in an Age of Strategic Competition," *The ASPI Strategist* (blog), June 13, 2019, https://www.aspistrategist.org.au/australia-in-an-age-of-strategic-competition/.

[57] Australian Government Department of Defence, *2016 Defence White Paper*, 32.

GDP and by "seek[ing] to broaden and deepen its alliance with the United States"[58] The document also stated that Australia could not achieve its desired security and stability level without the United States.[59] [60] These official statements clearly explain the advantages of Australia taking on the United States' side.

Australia and the United States have increasingly strengthened their security cooperation since the United States executed its "pivot to Asia" policy in responding to China's rising power. The United States claims that historically Australia and the United States have fought together "in every significant conflict since World War I, and [the United States] continues to reinforce economic and security arrangements that support our shared interests and safeguard democratic values across the region."[61] The two countries celebrated their "First Hundred Years of Mateship" in 2018.[62] Signed by Australia in 2011 and then ratified in 2014, the U.S. Force Posture Agreement (FPA) aims to "deepen its long-standing alliance and further strategic interests in maintaining a strong U.S. presence as an anchor of stability in the Asia-Pacific."[63] The FPA mentions Enhanced Air Cooperation and the stationing of the U.S. Marine Rotation Force in Darwin that brought its total number to 2,500 personnel in 2019.

Furthermore, in 2014, Australia and the United States also expanded the Australia, New Zealand, and the United States (ANZUS) security cooperation as "a vehicle for engaging Asia-Pacific countries"[64] to "ensure Asia-Pacific security."[65] The United States and Australia have also held an annual strategic dialogue through Australia–US Ministerial

[58] Australian Government Department of Defence, 15.

[59] Australian Government Department of Defence, 42.

[60] Turnbull, *2017 Foreign Policy White Paper*, 4.

[61] Trump, *National Security Strategy of the United States of America*, 46.

[62] U.S. Department of Defense, *The Department of Defense Indo-Pacific Strategy Report*, 26.

[63] "The Force Posture Agreement between the Government of Australia and the Government of the United States of America," Australian Treaty National Interest Analysis [2014] ATNIA 19, August 12, 2014, http://www.austlii.edu.au/au/other/dfat/nia/2014/19.html.

[64] Peter Chalk, *ASEAN Ascending: Achieving "Centrality" in the Emerging Asian Order* (Canberra, ACT: Australian Strategic Policy Institute, 2015), 6.

[65] Chalk, 1.

Consultations (AUSMIN) to "deepen bilateral foreign security and defence cooperation."[66] Additionally, Australia houses the U.S. defense facility knon as "the Pine Gap," which is a U.S. satellite surveillance base important for providing intelligence information and ballistic missile early warning.[67] The many examples of security cooperation show that both countries will undoubtedly continue to strengthen their alliance in the near future.

3. The Existing Views on Australia's Oil Security

The Australian government has taken energy matters seriously by issuing some official policy documents to deal with challenges and to harness all possible opportunities to resolve the energy trilemma. In 2011, the Department of Resources, Energy, and Tourism of the Australian government released the *National Energy Security Assessment* (NESA) report, which updated the previous version from 2009. This assessment provides essential basic knowledge for the decision maker in developing Australia's energy policy through the Energy White Paper process.[68] NESA 2011 concluded that in general, "Australia's energy security situation is meeting Australia's economic and social needs,"[69] which means that Australia has high energy security.[70] Furthermore, NESA 2011 stated Australia does not necessarily have problems, even though the country has a "lack of self-sufficiency and reliance on global markets."[71] According to NESA 2011, Australia had no problem filling Australian demands in three main energy areas. Oil fuels are managed diligently enough to sustain any disruption. The adequacy and reliability of the oil supplies will not be disturbed in the event of a disruption, but the price would increase for a short time, which means that only competitiveness could be affected.

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[66] "AUSMIN - Australia-United States Ministerial Consultations," Australian Government Department of Foreign Affairs and Trade, accessed April 29, 2020, https://www.dfat.gov.au/geo/united-states-of-america/ausmin/Pages/ausmin-australia-united-states-ministerial-consultations.

[67] Australian Government Department of Defence, *2013 Defence White Paper*, 58.

[68] Australian Government Department of Resources, Energy and Tourism, *National Energy Security Assessment 2011*, v.

[69] Australian Government Department of Resources, Energy and Tourism, v.

[70] Australian Government Department of Resources, Energy and Tourism, 3.

[71] Australian Government Department of Resources, Energy and Tourism, 11.

Furthermore, under the Department of Industry and Science, the Australian government published its energy policy through the latest Energy White Paper (EWP) in April 2015. This policy portrays the Australian vision on its energy sectors, which comprises effective market competition to get the lowest price, increasing energy productivity, and making future Australian energy investment.[72] The EWP 2015 emphasized Australian natural gas and electricity production as the way to foster Australian economic growth, and put less attention on the oil sector. Australia's oil resources are limited, which causes that country's dependency on oil import products. Nevertheless, in EWP 2015 the Australian government asserted that the described market approach would continue to provide a reliable oil supply "because of the depth, liquidity and diversity of international crude and fuel markets" and because this supply is supported by existing stockholding and tankers for sea management.[73] The Australian government will not, however, actively engage in promoting alternative fuels or inventing technology to encourage energy efficacy.[74] Additionally, the EWP 2015 admitted Australia's incapability to meet the IEA requirement to have 90 days of oil stock in reserve due to the massive cost for related infrastructure investment.[75] Following the second emphasis in the EWP, the Australian government, in December 2015, published its National Energy Productivity Plan (NEPP) 2015–2030. The NEPP goal is to improve "Australia's energy productivity by 40 percent between 2015 and 2030."[76] Doing so will strengthen Australian economic growth and also contribute to the global challenge of mitigating climate change by decreasing CO2 emissions by 5 percent in 2020.[77] This commitment reflects the Australian government's awareness of energy trilemma. The NEPP positions Australia as 28th in the

[72] Australian Government Department of Industry and Science, *Energy White Paper 2015* (Canberra, ACT: Australian Government Department of Industry and Science, 2015), 2.

[73] Australian Government Department of Industry and Science, 25.

[74] Australian Government Department of Industry and Science, 59.

[75] Australian Government Department of Industry and Science, 27.

[76] COAG Energy Council Hydrogen Working Group, *National Energy Productivity Plan 2015–2030: Boosting Competitiveness, Managing Costs and Reducing Emissions* (Canberra, ACT: Australian Government, Department of Industry, 2015), 12.

[77] COAG Energy Council Hydrogen Working Group, 6.

2019 World Trilemma ranking for 128 countries in which environmental sustainability was the weakest dimension.[78]

The latest Australian government publication on fuel security is the *Liquid Fuel Security Review Interim Report* of April 2019, which was initiated after Energy Minister Josh Frydenberg asked for an immediate fuel security review in May 2018.[79] The reason for his request was that Australia's fuel reserves was sufficient for, on average, 20 days of consumption. Nevertheless, he stated it was "not [to] be construed as Australia having a fuel security problem"[80] The report concluded, "that fuel security is not a problem to be solved but, rather, something to be monitored and managed to minimise risks as the market adapts to our changing needs over time."[81] Thus, the industry can manage any oil disruption and the government will intervene only as a last resort by implementing the Liquid Fuel Emergency Act of 1984. Even though Australia is 90 percent dependent on imported oil and the country's continued growth will mean prompt a greater demand for oil, the Australian government is unlikely to build storage facilities and new refineries in preparation for any disruption of the oil supply due to cost considerations.

Nevertheless, Australian energy security, especially its oil security, has been questioned by the Air Vice-Marshal John Blackburn AO (Ret'd), who released a series of reports through the National Roads and Motorists' Association (NRMA) in 2013 and 2014. He criticized Australia's oil security resilience by arguing that the country's "liquid fuels supply resilience in the face of a potential range of supply shocks is fragile."[82] The rise in

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[78] World Energy Council, *World Energy Trilemma Index: 2019* (London: World Energy Council, 2019).

[79] Frank Chung, "Government Launches Urgent Fuel Security Review as Reserves Dip Below 50 Days," News.com, last modified May 7, 2018, https://www.news.com.au/finance/economy/australian-economy/government-launches-urgent-fuel-security-review-as-reserves-dip-below-50-days/news-story/90a4e47c776fb505b9e14408d243705d#.zgiar.

[80] Chung.

[81] Australian Government Department of the Environment and Energy, *Liquid Fuel Security Review: Interim Report*, 1.

[82] John Blackburn, *Australia's Liquid Fuel Security: A Report for NRMA Motoring and Services* (Sydney, Australia: NRMA Motoring & Services, 2013), 16, https://www.aph.gov.au/DocumentStore.ashx?id=86e8dfbc-1467-47fe-ad1e-bc635407ecf8&subId=301736.

dependence on oil imports from 60 percent in 2000 to 90 percent in 2014[83] and with oil reserve levels at less than 23 days due to the decline of domestic oil capacity and the closure of several refineries, coupled with increasing oil demand and the lack of oil stockholding capability, did not attract Australian government attention to prepare any contingency plan for a disruption in the oil supply. The government's decision entirely relies on market forces and global supply chains to assure Australia's oil security and, thus, endangers Australia's national security.[84] Prioritizing the lowest oil price by not intervening in the market puts the Australian people indirectly at catastrophic risk should there be a disruption in the oil supply. Historically, Australia's oil security could adjust to disrupted supplies caused by global events such as the Iran-Iraq war, the Iranian revolution, the Libyan crisis, and the Hurricane Katrina; however, that security does not currently take intro consideration a broader scenario in which Australia is directly engaged in military conflict.

The tension in the region has makes Australia's oil security an important topic in that country. Australian senators and military experts have commented on Australia's current level of oil security. In January 2018, Senator Jim Molan, Major General of the Australian Army (Ret'd), stated that Australia's oil reserves were less than 21 days, and as a result, Australian military forces would be useless in 19 days, because there is little point in "having 12 fantastic submarines and 75 F-35s if you've got no bloody fuel for them"[85] Australian energy supplies are critical, he emphasized, and could be cut off quickly by any adversaries. His argument was backed up by Dr. Malcolm Davis, a senior analyst for Defence Strategy and Capability at the Australian Strategic Policy Institute, who then argued that the Australia government has ignored and did not take energy security seriously, even though military analysts have warned about it. Furthermore, Dr. Davis stated that a military conflict in the Pacific between the United States and China "could be

[83] Blackburn, *Australia's Liquid Fuel Security Part 2: A Report for NRMA Motoring & Services*, 5.

[84] Blackburn, *Australia's Liquid Fuel Security: A Report for NRMA Motoring and Services*, 21.

[85] David Samuel, "Clairvoyant on Fuel Security?," *Spectator Australia*, last modified June 29, 2019, https://www.spectator.com.au/2019/06/clairvoyant-on-fuel-security/.

the catalyst to disrupt Australia's fuel supply.[86] Similar support for this view came from Professor Peter Leahy, director of the University of Canberra's National Security Institute and former chief of the Australian Army, who argued that the Australian government had yet to act since 2013, when John Blackburn wrote the first Australia fuel security report.[87]

In 2018, Blackburn followed up his series of reports in 2013 and 2014 with a journal article. In that article, he argued the Australian market-based strategy was out of date because the environment was not always peaceful and the market would be unable to work normally in a conflict situation. He emphasized the importance of viewing energy security through a national security lens that integrated all the factors for consideration, not only in terms of the economic advantages. Blackburn explained further that Australia was "in a strategic warning period for fuel security" due to "the deteriorating security environment in the Asia Pacific region" and needed preparation to deal with it.[88] His statement aligned with the Australia Strategic Policy Institute (ASPI) view that "now isn't the time to pretend that a business-as-usual approach in the Australian energy sector is a viable strategy that provides support for national energy resilience."[89] The Australian government, according to the IEA, is "less clear how the country would respond in the event of a serious oil supply disruption leading to market failure."[90]

The instability of the Indo-Pacific region and the probability of conflict directly affects Australia's oil security. Given the previously discusses facts about insecurity in the Indo-Pacific region, the Australian alliance with the United States, the determination of Australian top leaders, and Australian defense preparedness, if a conflict occurs, Australia will have a serious fuel security problem as most oil supply chains are located in the area

[86] Matt Young, "Stark Warning from Military Experts on Australia's Future," News.com, last modified January 5, 2018, https://www.news.com.au/technology/new-senator-and-retired-military-chief-jim-molans-stark-warning/news-story/ff8012248e53aba5c2cff3d832f02aba#.mxmqh.

[87] Chung, "Government Launches Urgent Fuel Security Review."

[88] John Blackburn, "Energy Security: Is There a Problem?," *Australian Defence Magazine*, September 10, 2018, https://www.australiandefence.com.au/budget-policy/energy-security-is-there-a-problem.

[89] Neil Greet and Paul Barnes, *The Challenge of Energy Resilience in Australia: Strategic Options for Continuity of Supply* (Canberra, ACT: Australian Strategic Policy Institute, 2017), 26.

[90] International Energy Agency, *Energy Policies of IEA Countries: Australia 2018 Review* (Paris: International Energy Agency, 2018), 51, https://webstore.iea.org/energy-policies-of-iea-countries-australia-2018-review.

of conflict, the Indo-Pacific region. This research, however, does not aim to address the developing situation in Indo-Pacific maritime security in detail. Rather, this research examines the Australian government's ongoing and planned programs to protect Australia's oil security and how those programs can help Australia's quest for improved energy security against the backdrop of Indo-Pacific maritime security as described in this chapter.

D. POTENTIAL EXPLANATIONS AND HYPOTHESES

This thesis primarily addresses Australian energy security policy, the country's oil development programs, and how those programs are helping the country achieve greater security in view of increasing uncertainty in the Indo-Pacific that threatens all of its oil routes. Building on the available literature presented in the previous section, this thesis advances three hypotheses related to the research question.

First, I hypothesize that the Australian government will need to diversify its sources of oil to include countries from outside of the area at risk for conflict. The countries on the American continent, for example, are a good alternative because of their stable geopolitical condition and ability to avoid passing through the China Sea and other critical choke points, such as the Malacca and the Hormuz straits. The establishment of long-term agreements and strategic partnerships, such as the Australia−U.S. energy strategic partnership, can help to ensure Australia's energy security.

Second, I hypothesize that the Australian government will continue to execute a market-based driven policy that emphasizes economic advantages, keeps its dependency on imported oil, and avoids interfering directly in its oil sector. Australia is also unlikely to build new oil infrastructure due to the associated costs, but the country will improve its oil reserve capability and capacity so that Australia can respond effectively to short-medium disruptions in the oil supply.

Third, I hypothesize that the Australian government will reduce domestic oil consumption to improve its energy security. Australia can leverage new technologies to convert equipment that uses oil to other fuel types. Furthermore, the Australia government can explore production of alternative fuel types to replace oil by drawing on its huge natural

gas, coal, and renewable energy resources. The biofuel and hydrogen fuel programs are also promising for Australia.

E. RESEARCH DESIGN

This thesis examines Australia's energy situation in detail and the policies that the country's government has adopted to improve its energy security situation. The thesis then examines ongoing programs, such as the U.S. Indo-Pacific strategy and the implications it has for Australian energy security. Specifically, the ways in which that strategy potentially assists Australia's quest for improved energy security are analyzed. Finally, several recommendations are provided for improving Australian energy security.

F. THESIS OVERVIEW

This chapter provided background on Australia's energy security and various perspectives on the risk to the oil supply caused by instability in the Indo-Pacific maritime environment. Chapter II covers the current status of Australia's oil security, starting with its resources, demand, supply, and challenges. Chapter III discusses the Australian government's energy policy and its development programs. Chapter IV explores the role of Australia's strategic energy partnership in supporting that country's oil security. Finally, Chapter V synthesizes the findings from the previous chapters to assess how Australia's energy policy and development efforts are helping the country achieve greater energy security. The chapter concludes by offering recommendations on how Australia could effectively respond to a significant oil supply disruption resulting from conflict in the region.

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II. AUSTRALIAN ENERGY RESOURCES: DEMAND AND THREATS TO SECURITY

Australia's population uses a significant amount of energy to support its life and development. Each year, the country's energy needs continue to grow. Australia can meet many of its energy needs through its domestic resources supplies of oil, coal, and natural gas. Nonetheless, it has started to experience a shortage of domestic oil. Therefore, it will need to increase its import of oil products and become more dependent on international supply. Australia's oil supply chains, however, contain a high risk due to transit choke points located in the unstable Middle East and uncertain Indo-Pacific security environments.

This chapter shows how Australia lacks of self-sufficiency in fuel oil and is dependent on imported oil supplies that are at increased risk of disruption due to SLOCs that originate and cross the unstable Middle East and uncertain Indo-Pacific security environments. In doing so, this chapter first describes the general overview of the Australian energy situation and resources. Next, it discusses the Australian demand for three primary energy sources: oil, natural gas, and electricity. This chapter then determines the shortages in the Australian domestic energy market. Furthermore, it describes the imported-energy sources that Australia uses to fill the gap in the fuel oil sector. Finally, this chapter wconcludes with findings about the current energy security situation in Australia, primarily fuel oil security, and the factors enabling Australia to overcome its oil security issues.

A. GENERAL OVERVIEW

Australia's population continues to grow and demand more energy annually. In the period 2017–18, the Australian population grew 1.6 percent, reaching 25 million people, and alongside its increased population, the energy demand also increased by 0.9 percent.[91]

[91] Australian Government Department of the Environment and Energy, *Australian Energy Update 2019* (Canberra, ACT: Australian Government Department of the Environment and Energy, 2019), 2, https://www.energy.gov.au/sites/default/files/australian_energy_statistics_2019_energy_update_report_september.pdf.

Australian energy consumption reached 6,171.7 petajoules, 94 percent of which was consumption of fossil fuels (oil, coal, gas) and the other 6 percent from renewable energy (see Table 1).[92] In 2016, Australia became one of the top ten energy-consuming countries, occupying the eighth position among 24 other countries.[93] The transportation, electricity supply, and manufacturing sectors have dominated Australian energy consumption, together reaching 70 percent of the country's total energy consumption.[94] The three primary types of energy consumed by Australia are electricity, oil, and natural gas, and all are used for economic development and to meet the basic needs of people. In 2017–18, Australian energy consumption for every petajoule generated A$294 million in gross domestic product (GDP), an increase of A$50 million more than in the previous decade.[95]

Table 1. Australian energy consumption, by fuel type[96]

	2017–18		*Average annual growth*	
	PJ	share (per cent)	2017–18 (per cent)	10 years (per cent)
Oil	2,387.8	38.7	3.2	2.0
Coal	1,847.2	29.9	-4.3	-2.6
Gas	1,554.6	25.2	3.8	2.4
Renewables	382.1	6.2	0.9	5.3
Total	**6,171.7**	**100.0**	**0.9**	**0.6**

[92] Australian Government Department of the Environment and Energy, 8.

[93] Global Energy Institute of the U.S. Chamber of Commerce, *International Index of Energy Security Risk: Assessing Risk in a Global Energy Market*, 2.

[94] Australian Government Department of the Environment and Energy, *Australian Energy Update 2019*, 2019, 15.

[95] Australian Government Department of the Environment and Energy, 8.

[96] Source: Australian Government Department of the Environment and Energy, *Australian Energy Update 2019*, 2019, 9.

Fortunately, Australia has a tremendous amount of varied energy resources that make it one of the top energy-producing countries in the world. Australia is known as the country with the most substantial economy in terms of uranium resources globally, the fourth largest in coal resources (black and brown), and it claims abundant conventional and unconventional gas resources.[97] Having abundant resources such as these allows Australia to sufficiently fill the domestic demand and makes it one of the world's leading energy-exporting countries. Australia is currently the world's largest exporter of coal and the second-largest exporter of liquefied natural gas (LNG).[98] The resources are spread out in several locations across the country, but mostly in the northwest of Australia. Conversely, although it has abundant natural gas, coal, and uranium resources, Australia has limited oil resources. The high demand for oil makes Australia a net oil-importing country.

The energy sector makes a significant contribution to the Australian development program and its people's prosperity. The Australian government, through its *Australian Energy Update 2019* report, stated that Australia's energy production reached 18,603 petajoules between 2017 and 2018.[99] In detail, the government explained that production increased by four percent due to the increase in natural gas and black coal sector production. Furthermore, the government said that two-thirds of this energy production was exported, which bolstered the growth of the Australian economy 2.8 percent to A$1.8 trillion. The Australian government prioritized the energy sector to support and sustain the continuity of Australia's development programs. Crucial to meeting energy demands is the importing of crude oil and refined products. Yet, this poses challenges arise due to the increasing geopolitical tension that threatens Australia's oil SLOCs.

[97] Australian Government Geoscience Australia, "Australian Energy Resources Assesment: Executive Summary," Australian Government Geoscience Australia, accessed July 7, 2020, https://aera.ga.gov.au/#!/executive-summary.

[98] Global Energy Institute U.S. Chamber of Commerce, *International Index of Energy Security Risk: Assessing Risk in a Global Energy Market,* 18.

[99] Australian Government Department of the Environment and Energy, 3.

B. ENERGY DEMAND

Among all types of energy, Australia consumes oil at the highest rate. In 2017–18, oil represented almost 39 percent of Australia's total energy consumption by fuel type, reaching 2,387.8 petajoules[100] or 52.1 percent[101] of Australia's final energy consumption. Most of the oil usage was for the Australian transportation sector, which accounted for 75 percent of Australian total oil demand, of which 98 percent was used by Australian vehicles relying on fuel oil.[102] The rising demand especially for road transportation and air travel bolstered a significant increase in oil use. In 2017–18, road transportation consumed nearly 72 percent of fuel oil, followed by air transportation, which took 20 percent.[103] In 2019, according to Australian motor vehicle registration figures, the number of vehicles in Australia reached 20 million, which caused oil demand to rise 2 percent.[104] The largest increase was for diesel fuel, which doubled due to the trend of Australian people switching from vehicles that run on petrol (gasoline) to diesel. The number of diesel vehicles, which are used for passenger transport as well as industrial purposes, reached 4.8 million in 2019,[105] and the Bureau of Infrastructure, Transport and Regional Economics (BITRE) has predicted that diesel consumption will grow by 52 percent from 2016 to 2036.[106] This number reflects that the Australian people tend to use road vehicles to support their way of life and business activities, and this trend is likely to continue for the next decade in step with population growth and economic growth.

[100] Australian Government Department of the Environment and Energy, 9.

[101] Australian Government Department of the Environment and Energy, 18.

[102] Australian Government Department of the Environment and Energy, *Liquid Fuel Security Review: Interim Report*, 15.

[103] Australian Government Department of the Environment and Energy, *Australian Energy Update 2019*, 2019, 13.

[104] Australian Government Department of the Environment and Energy, 14.

[105] Australian Government Department of the Environment and Energy, 14.

[106] Australian Government Department of the Environment and Energy, *Liquid Fuel Security Review: Interim Report*, 15.

Electricity also has a vital role for the Australian people in that it supports most Australian industries and household needs. Electricity represented the second-largest sector of Australian energy consumption in 2017–18; it reached 26.3 percent or 1,731.8 petajoules.[107] According to the Australian Department of Industry, Science, Energy, and Resources, in 2019, fossil fuel-dominated electricity generation plants contributed 79 percent of this power; meanwhile, renewable energy contributed 21 percent.[108] Furthermore, the department stated that coal provided 56 percent and natural gas 21 percent, respectively, of total electricity generation in 2019.[109] The use of coal for electricity generation, however, has consistently declined from 80 percent in 2017 to 60 percent in 2018 due to the conversion of coal-fired generation to natural gas-fired generation and the development of renewable energy for generation.[110] This decline shows Australia's gradual success in committing to support the Paris Climate Agreement by decreasing CO2 emissions. Nevertheless, the coal-fired electricity generation still contributes signficantly to Australia's CO2 emissions, which positioned Australia as the third-highest CO2-producing country among all IEA members in 2015, with 0.36 kg CO2 per USD/GDP PPP.[111] In light of that issue, the Australian government prioritizes natural gas usage to support environmental programs.

Natural gas is the third-largest source of Australian energy; this is vital to support Australian wealth and prosperity. According to the Australian Department of Environment and Energy, in 2017–18, Australia's gas production was 4,731 petajoules, and 33 percent

[107] Australian Government Department of the Environment and Energy, *Australian Energy Update 2019*, 2019, 12.

[108] "Australian Energy Statistics, Table of Electricity Generation by Fuel Type 2018-19 and 2019," Australian Government Department of Industry, Science, Energy and Resources, May 26, 2020, https://www.energy.gov.au/sites/default/files/Australian%20Energy%20Statistics%2C%20Table%20O%20Electricity%20generation%20by%20fuel%20type%202018-19%20and%202019.pdf.

[109] Australian Government Department of Industry, Science, Energy and Resources.

[110] Australian Government Department of the Environment and Energy, *Australian Energy Update 2019*, 2019, 25.

[111] International Energy Agency, *Energy Policies of IEA Countries: Australia 2018 Review*, 173.

of its output was used for domestic needs.[112] Furthermore, the government said that Australia's natural gas consumption reached 25 percent of Australia's total energy consumption; 37 percent alone was used to generate electricity. The use of natural gas to generate electricity will continue to grow in response to world efforts to combat climate change. Natural gas is the cleanest of fossil fuels in terms of carbon emissions. According to Meghan L. O'Sullivan, "natural gas is only half as carbon intensive as coal and a quarter less than oil."[113] Converting from coal-fired generation to gas generation can help mitigate CO2 emissions while Australia develops more non-fossil fuel or renewable energy sources, such as hydro, solar, and wind, in the long term.

C. DOMESTIC SUPPLY RESOURCES AND SHORTAGES

Australia has been acknowledged as a country with rich and varied energy resources. Those resources are exploited for Australian needs, and many are exported, which provides substantial revenue to Australia. The appropriate use of its income has transformed Australia into a developed country. This section discusses the availability of oil, coal, and natural gas and their ability to support Australia's energy needs for the future.

1. Oil

In Australia, oil resources are found in several parts of the Australian continent, both onshore and offshore, particularly in the Northern Territory and the northwest coast of Australia.[114] These resources have been and are still being exploited in ten basins: the Bonaparte, Browse, Carnarvon, Perth, Canning/Roebuck, Cooper/Eromanga,

[112] Australian Government Department of the Environment and Energy, *Australian Energy Update 2019*, 2019, 10.

[113] Meghan L. O'Sullivan, *Windfall: How the New Energy Abundance Upends Global Politics and Strengthens America's Power* (New York: Simon & Schuster, 2017), 68.

[114] "Australian Energy Resources Assessment: Oil," Australian Government Geoscience Australia, accessed July 20, 2020, https://aera.ga.gov.au/#!/oil.

Bowen/Surat, Bass/Otway, and Gippsland Basins (see Figure 2).[115] Most of its oil production comes from offshore Western Australia, and this oil is almost entirely destined for export. Yet, Australia's oil production has steadily declined since 2001 due to depleting oil reserves and no significant exploitation of new oil fields. Australia's oil reserves accounted for 0.2 percent of the world reserves in 2014,[116] and by 2019, this figure had decreased to 0.1 percent.[117] According to AERA, in 2014–15, oil production declined 4.6 percent from its peak production in 2001–02.[118] In 2017–18, oil production continued falling by four percent compared to 2018–19[119] or 60 percent lower than in 2000–01.[120] The decline of oil production will continue to occur until at least 2030 if there are no new significant oil fields to exploit.[121] Except for the Browse and Bass/Otway basins, other Australian basins have been exploited more than fifty percent of their oil reserves. Currently, the remaining crude oil reserves in these basins are deficient. Australia's current oil production is largely condensate instead of crude oil. In 2018–19, Australia's oil production was 18,293 ML of which condensate accounted for 64 percent[122] and 14,739.2 ML or 80 percent of its production was exported.[123]

[115] Australian Government Geoscience Australia.

[116] Australian Government Geoscience Australia.

[117] BP, *Statistical Review of World Energy 2020*, 69th ed. (London: BP, 2020), 14, https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2020-full-report.pdf.

[118] Australian Government Geoscience Australia, "Australian Energy Resources Assessment: Oil."

[119] Australian Government Department of the Environment and Energy, *Australian Energy Update 2019*, 2019, 3.

[120] Australian Government Department of the Environment and Energy, *Liquid Fuel Security Review: Interim Report*, 25.

[121] Australian Government Department of the Environment and Energy, 25.

[122] Australian Government Department of Industry, Science, Energy and Resources, *Australian Petroleum Statistics*, Issue 286 (Canberra, ACT: Australian Government Department of Industry, Science, Energy and Resources, 2020), 6, https://www.energy.gov.au/sites/default/files/Australian%20Petroleum%20Statistics%20-%20Issue%20286%20May%202020.pdf.

[123] Australian Government Department of Industry, Science, Energy and Resources, 55.

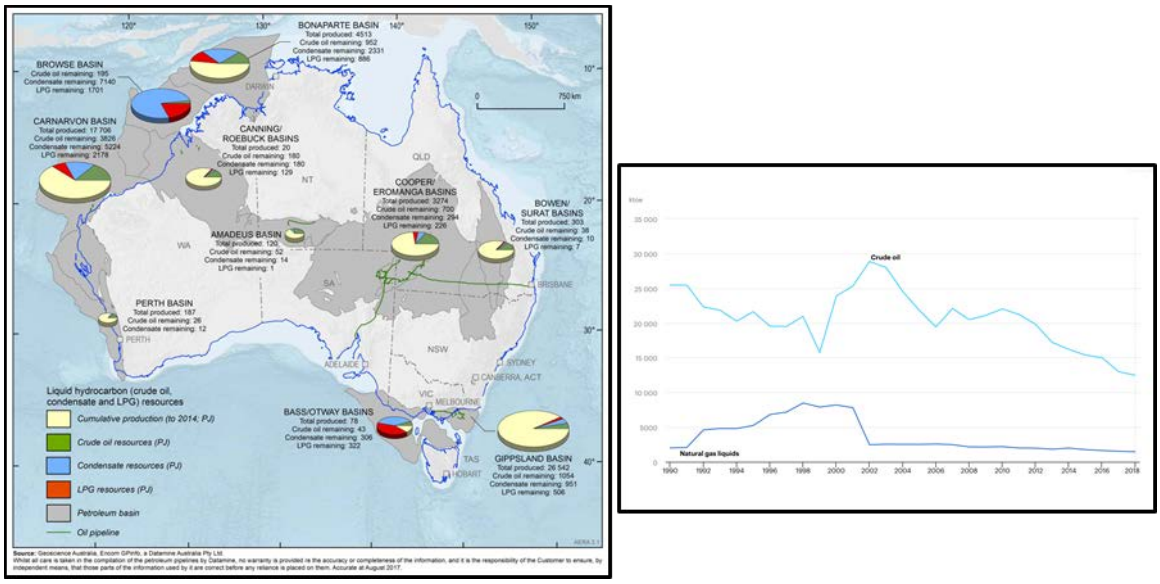

Figure 2. Australian oil basins and production[124]

Not all Australian crude oil production can be used for Australian refineries' feedstock because oil from the western and eastern parts of Australia have different qualities and characteristics. The oil produced in Western Australia does not meet the requirement of domestic refineries' feedstocks.[125] Furthermore, the locations of fields are too far from most Australian refineries, which are located mostly in eastern Australia. Based on those considerations, exporting Western Australia's oil production is a more profitable option. Meanwhile, eastern Australia's oil production is suitable for domestic refineries' feedstocks. However, its oil reserves amount is limited and on a small scale of production. Based on the Australian petroleum statistics of 2020, the eastern oil field produced 22 percent of total Australian production in 2018–19.[126]

[124] Source: Australian Government Geoscience Australia, "Australian Energy Resources Assessment: Oil."

[125] Australian Government Geoscience Australia.

[126] Australian Government Department of Industry, Science, Energy and Resources, *Australian Petroleum Statistics*, 9.

Australia has few refineries to produce processed petroleum products. Before 2003, Australia had eight operational refineries located mostly in the eastern Australia territory (see Figure 3).[127] However, from 2003 to 2015, four refineries were closed because they could not economically compete due to their small size in comparison to Asian mega refineries.[128] Consequently, since then, refined domestic products have decreased significantly; in 2019, local refineries in Australia met 48 percent of the total demand for petroleum products by Australian industries and people. These products were distributed through 7,100 service stations.[129] However, this percentage included Australia's exports of refined petroleum products. When only domestic consumption is considered, the Australian refineries provided only 40 percent of domestic use. This 40 percent share is similar to that reported in the 2017–18 report, where it was stated that 40 percent local production and 60 percent from imports of refined petroleum products.[130]

[127] "Crude Oil Refining and Australia's Fuel Security," Fuel Equipment Specialists Tanks, accessed July 19, 2020, https://www.festanks.com.au/crude-oil-refining-in-australia-infographic/.

[128] Brian Robins, "BP Refinery Closure Leaves Australia More Reliant on Fuel Imports," *Sydney Morning Herald*, last modified April 2, 2014, https://www.smh.com.au/business/companies/bp-refinery-closure-leaves-australia-more-reliant-on-fuel-imports-20140402-35y4p.html.

[129] Australian Institute of Petroleum, *Downstream Petroleum: Australian Liquid Fuel Supply and Demand* (Canberra, ACT: Australian Institute of Petroleum, 2019), 2, https://www.aip.com.au/sites/default/files/aip_downstream_petroleum_report-3_australian_liquid_fuel_supply_and_demand.pdf.

[130] Australian Government Department of the Environment and Energy, *Liquid Fuel Security Review: Interim Report*, 23.

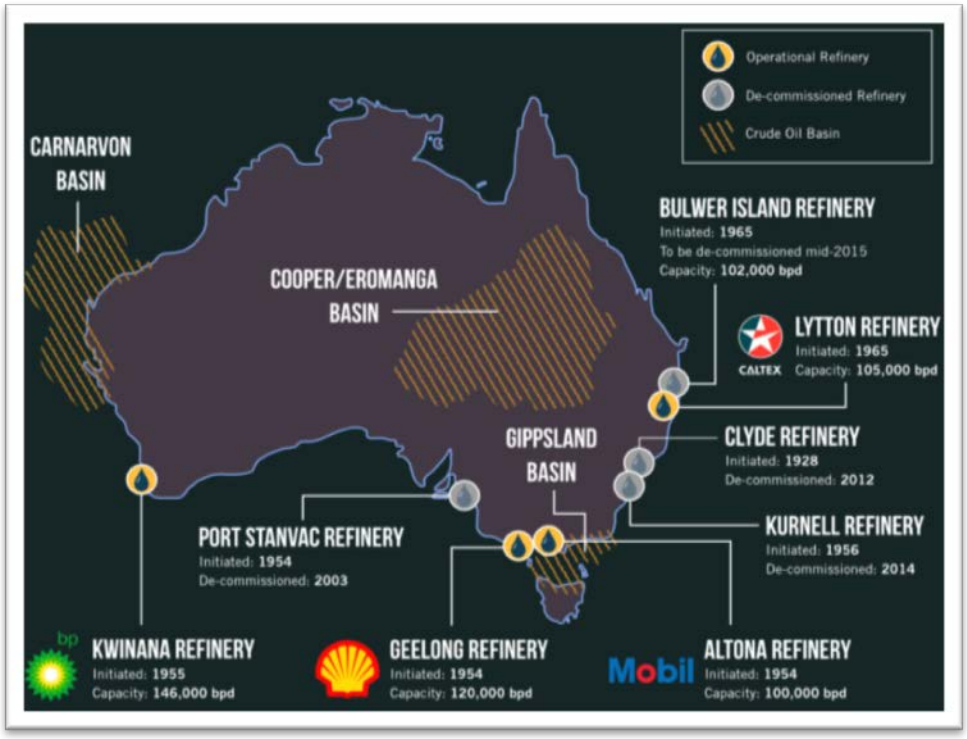

Figure 3. Australian refineries[131]

The new mega refineries in Asia and the Middle East challenge the competitiveness of Australian refineries.[132] The high cost for routine maintenance of aging refineries, high cost of labor, and low price of refined import products affect the sustainability of Australia's oil refineries in the future. According to Blackburn, a continuing decline in Australia's oil production, if there are no government interventions, Australia will likely have no refineries by 2030.[133] All existing Australian refineries were constructed in and have been in operation since the 1960s and mostly have run at 90 percent production

[131] Source: Fuel Equipment Specialists Tanks, "Crude Oil Refining and Australia's Fuel Security."

[132] ANZ Terminals Pty Ltd, *Submission to the Liquid Fuel Security Review* (Melbourne Australia: ANZ Terminals Pty Ltd, 2019), 7, https://www.environment.gov.au/submissions/liquid-fuel-security-review/anz-terminals.pdf.

[133] Blackburn, *Australia's Liquid Fuel Security Part 2: A Report for NRMA Motoring & Services*, 8.

capacity.[134] This situation means that current production from Australian refineries meets less than half to the demand for refined petroleum products and cannot be bolstered to produce much more than current production; they have almost reached their maximal production level.

Australia's domestic oil production contributes a small percentage in meeting Australia's oil needs, and it will likely continue to decline in the future. Australia's indigenous oil production contribution to its refineries' feedstocks in 2018–19 was 19.2 percent, which means that crude oil import reached 80.8 percent.[135] It can be calculated that domestic oil production suitable to Australia's oil refineries only contributed nine percent of total refined petroleum product consumption. In total, Australia's dependence on oil imports, both crude oil and refined petroleum product, reached 91 percent. Even if all crude oil production in 2018–19 had been used for domestic refineries' feedstocks, this production would only have covered 25 percent of Australian refined petroleum product consumption.[136] As early as 2030, Australia is predicted to be 100 percent dependent on petroleum imports if there are no upgrades to its refineries or decline in demand.[137]

2. Coal

Australia has a substantial amount of coal reserves that can support the energy needed by Australia for a very long time and bring in significant revenue as an Australian export commodity.[138] At the end of 2019, Australia's total proven coal reserves ranked

[134] Australian Government Department of the Environment and Energy, *Liquid Fuel Security Review: Interim Report*, 27.

[135] Australian Government Department of Industry, Science, Energy and Resources, *Australian Petroleum Statistics*, 10.

[136] Australian Government Department of the Environment and Energy, *Liquid Fuel Security Review: Interim Report*, 24.

[137] Fuel Equipment Specialists Tanks, "Crude Oil Refining and Australia's Fuel Security."; Blackburn, *Australia's Liquid Fuel Security Part 2: A Report for NRMA Motoring & Services*, 7.

[138] "Australian Energy Resources Assessment: Coal," Australian Government Geoscience Australia, accessed July 23, 2020, https://aera.ga.gov.au/#!/coal.

third in the world behind the Russian Federation and the United States, with 13.9 percent of world coal reserves.[139] This immense value gives Australia a source of energy for its people and industries. The industries exploit coal resources to generate electricity and to produce an excellent export commodity. At the end of 2019, Australian coal production was the third-largest in the world, with 7.8 percent of total world production behind China and the United States,[140] of which 74 percent of its production was exported. This made Australia the largest coal exporter.[141] Meanwhile, Australia consumes a small amount of its coal production; at the end of 2019, it consumed only 14 percent of its total coal production.[142] Most of its consumption has been used to generate electricity for household and industry needs.

Australia's coal resources consist of two different types of coal: black and brown. Both can be found mostly in the eastern part of the Australian continent. Queensland and New South Wales have most of the coal resources (see Figure 4).[143] At the end of 2018, Australia had 10 percent of the world's black coal resources and 24 percent of world's brown coal resources.[144] By 2018, it was estimated that Australia's total measured, indicated, and inferred black coal resources could support Australia for the next 68 years, whereas brown coal could support Australia for the next 1,000 years with the same amount of annual coal extraction as in 2018.[145]

[139] BP, *Statistical Review of World Energy 2020*, 44.

[140] BP, 46.

[141] BP, 49.

[142] BP, 47.

[143] Australian Government Geoscience Australia, "Australian Energy Resources Assessment: Coal."

[144] A. Senior et al., *Australia's Identified Mineral Resources 2019* (Canberra, ACT: Geoscience Australia, 2020), 19, https://doi.org/10.11636/1327-1466.2019.

[145] Senior et al., 28–29.

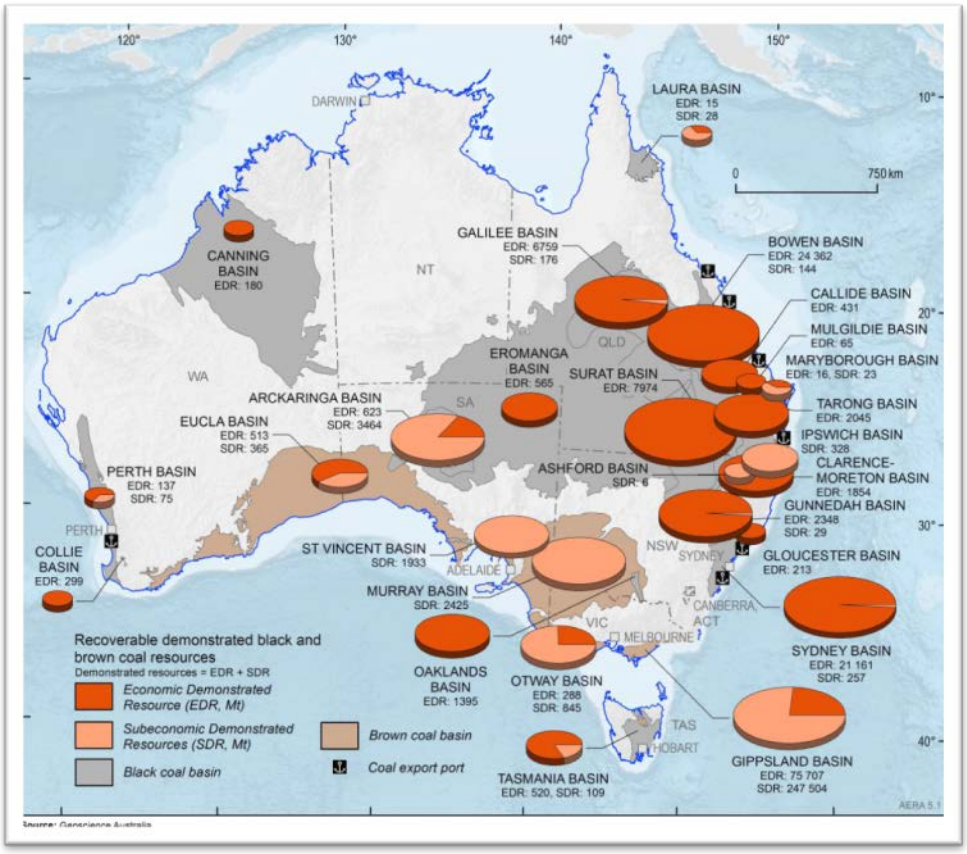

Figure 4. Australian coal resources[146]

Australian coal availability will likely be able to support Australian energy needs longer than predicted in 2018 due to the wave of activist movements in the world and domestically because of concern for climate change. On November 10, 2016, Australia ratified the Paris Climate Agreement; since then, Australia has tried to reduce its CO2 emission by intensifying the use of more friendly energy sources such as natural gas and renewable energy.[147] These efforts will automatically reduce the use of coal, including in Australia, which will prolong coal availability.

[146] Source: Australian Government Geoscience Australia, "Australian Energy Resources Assessment: Coal."

[147] Sophie Power, "Paris Climate Agreement: A Quick Guide," Parliament of Australia, last modified November 10, 2017, https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/rp1718/Quick_Guides/ParisAgreement.

Australia's domestic coal consumption is used mostly to produce electricity. Even though the trend of coal use is declining, coal is still the most significant contributor to electricity generation. In 2019, according to Australian Energy Statistics 2019, coal contributed to 56 percent of total electricity production.[148] The most important fact to be highlighted is that coal can meet Australian needs as the source of electricity. With tremendous reserves, in case there is a surging demand for electricity, Australia can rely on coal to produce more electricity in the future.

3. Natural Gas

Australia is rich in gas resources inshore and offshore across the country. Based on the Australian Energy Resources Assessment (AERA), Australia has 14 basins containing gas resources, of which the Browse, Carnarvon, and Bonaparte basins, located in the northwest part of the continent, are the most significant contributors (see Figure 5).[149] The Australian gas resources consist of conventional gas and unconventional gas, such as tight gas, shale gas, and coal seam gas. In 2015, Australia's total gas resources were approximately 279,685 petajoules, an amount that Geoscience Australia estimated would last for 106 years at that time, given average production, and its gas reserves could support Australia for the next 47 years. Due to the massive development and exploitation of natural gas as LNG as a profitable export commodity, the Australian gas reserves at the end of 2019 were 84.4 trillion cubic meters, which will last for 22 years at a 153.5 billion cubic meters production level.[150] Australia became the world's largest LNG exporter in 2019 with the volume of exported gas reaching 77 million tons, giving Australia revenue of A$49 billion.[151] According to the Australian Department of Industry, Science Energy, and

[148] Department of Industry, Science, Energy and Resources, *Australian Energy Statistics, Table of Electricity Generation by Fuel Type 2018–19 and 2019*, 3.

[149] "Australian Energy Resources Assessment: Gas," Australian Government Geoscience Australia, accessed July 24, 2020, https://aera.ga.gov.au/#!/gas.

[150] BP, *Statistical Review of World Energy 2020*, 34–35.

[151] Australian Government Department of Industry, Science, Energy and Resources, *Resources and Energy Quarterly June 2020* (Australia: Australian Government Department of Industry, Science, Energy and Resources, 2020), 74, https://publications.industry.gov.au/publications/resourcesandenergyquarterlyjune2020/documents/Resources-and-Energy-Quarterly-June-2020.pdf.

Resources, this trend will continue for the next two years, and Australian LNG export is predicted to reach its peak of 80 million tons in 2020–2021.[152]

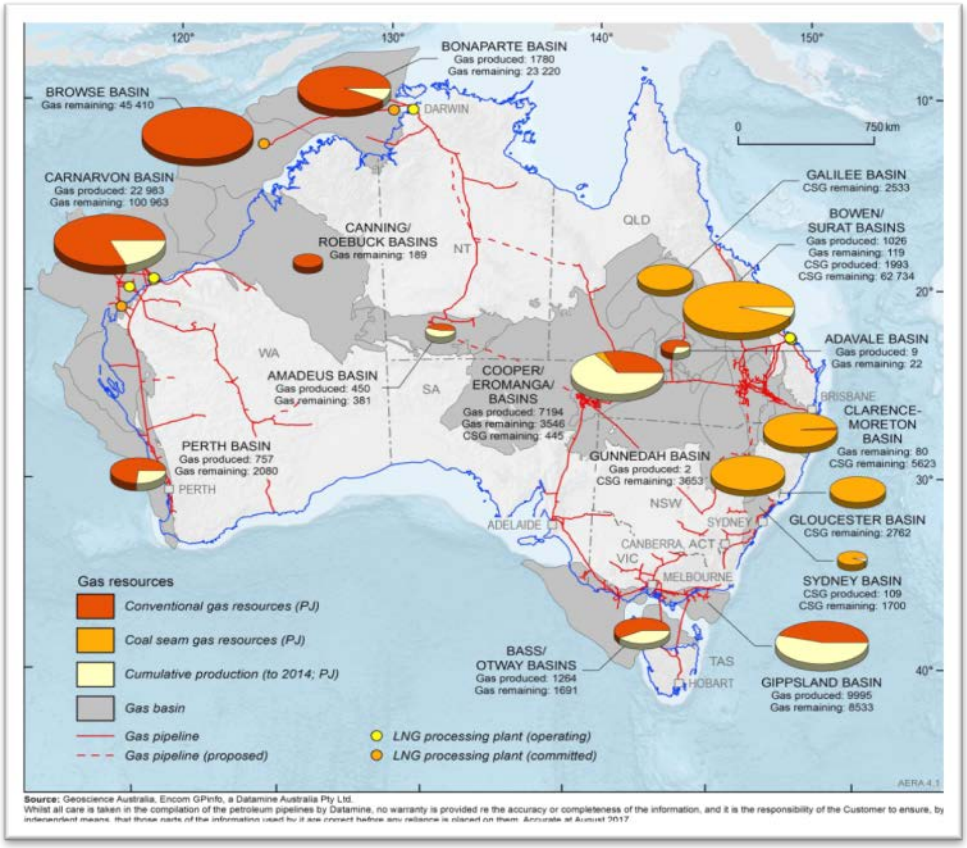

Figure 5. Australian gas resources[153]

Australian gas availability will continue supporting Australian gas needs longer than predicted at the end of 2019 due to a decline in LNG export. The Australian Industry, Science, Energy, and Resources Department forecasts that Australian LNG exports will decline in 2021 to roughly 50 million tons.[154] The production output, in turn, will also

[152] Australian Government Department of Industry, Science, Energy and Resources, 75.

[153] Source: Australian Government Geoscience Australia, "Australian Energy Resources Assessment: Gas."

[154] Australian Government Department of Industry, Science, Energy and Resources, *Resources and Energy Quarterly June 2020*, 75.

decline due to the low oil prices that reduce capital expenditure. According to the *Resources and Energy Quarterly* report of June 2020, this situation has led to a suspension of additional investment in the exploitation of new gas fields to replace exhausted gas fields.[155] The report adds that four LNG projects have also been delayed for that reason.

D. IMPORT SUPPLY RESOURCES

Australia imports oil products to meet its domestic demand because this demand exceeds its local production capacity. Given the declining levels of its oil reserves and the closures of its four refineries after its peak oil production in 2000–1, Australia gradually came to rely on imported oil to meet its domestic consumption. A supply disruption helped spark awareness of oil security among Australian strategic experts and scholars. This situation required the Australian government, in 2017, to issue a policy that obligated all companies to report monthly on their oil status. The newest official information from the Australian government was reported in *Australian Petroleum Statistics* issued in May 2020. Based on the data presented in this report, in 2018–19, the calculation showed that Australia's oil imports reached 91 percent in 2019 from 60,644.1 petajoules total oil consumption.[156] This percentage was divided into two types, namely crude oil and refined petroleum products, with refined petroleum imports reaching 60 percent, and crude oil imports accounting for 81 percent of its total domestic demand.

Australia imports oil from many different countries in order to strengthen its supply against disruption. In 2018–19, crude oil was imported from 26 countries, led by Malaysia, the United Arab Emirates (UAE), and Brunei Darussalam, with percentages from total crude oil import, respectively, of 31 percent, 17 percent, and 7 percent (see Figure 6).[157] Unfortunately, there is an imbalance among the regions that export their oil to Australia. In 2018–19, Australia imported 11,818.2 ML of crude oil, mostly from Southeast Asian countries, which represents 55 percent of its total crude oil imports. The Middle East region

[155] Australian Government Department of Industry, Science, Energy and Resources, 74.

[156] Australian Government Department of Industry, Science, Energy and Resources, *Australian Petroleum Statistics*, 12.

[157] Australian Government Department of Industry, Science, Energy and Resources, 51–52.

follows as the second supplier, with a 20 percent crude oil contribution. This percentage means that the uncertain geopolitical situation in the Southeast Asia region will have a severe impact on Australia's oil security, namely crude oil supply disruption. Unfortunately, most of these countries have maritime border disputes with China that continue today, which adds risk to Australia's oil security.[158]

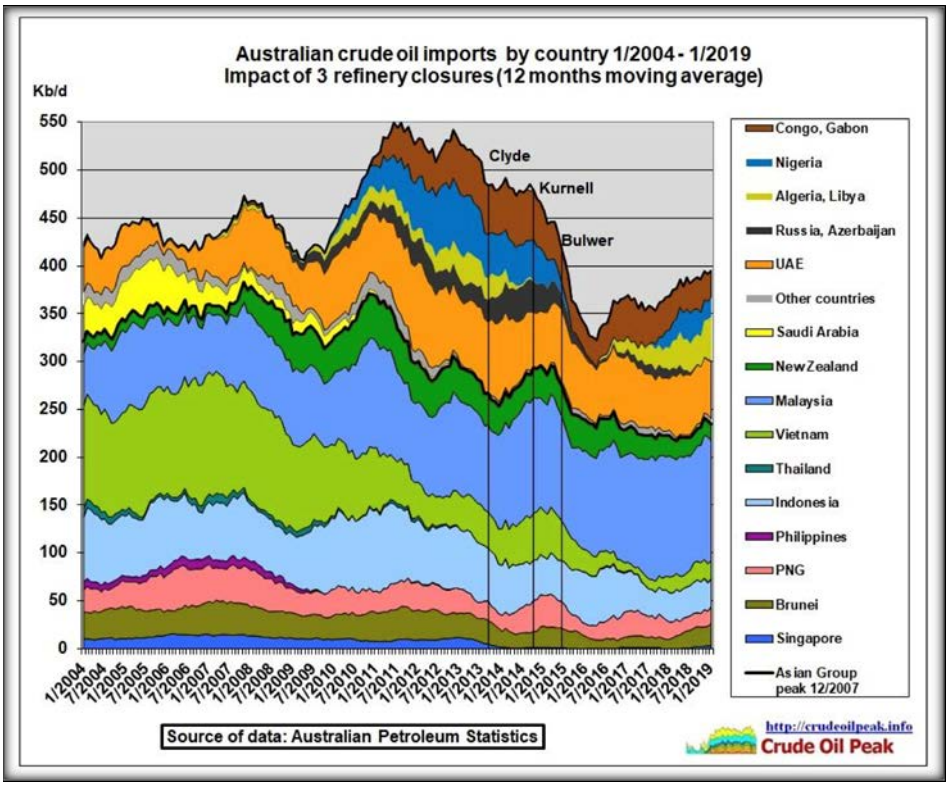

Figure 6. Australian crude oil countries' supplier[159]

Though the Australian import of refined oil products is dominated by Southeast/East Asian countries as suppliers, most of this oil actually originates in the Middle East. Similar to crude oil import, 26 countries supply refined products to Australia

[158] Joseph Tertia and Anak Agung Banyu Perwita, "Maritime Security in Indo-Pacific: Issues, Challenges, and Prospects," *Jurnal Ilmiah Hubungan Internasional* 14, no. 1 (2018): 82, https://doi.org/10.26593/jihi.v14i1.2795.77-95.

[159] Source: Matt Mushalik, "Australia Outsources Its Oil Reserve Problem to the US," *Crude Oil Peal* (blog), May 22, 2020, https://crudeoilpeak.info/australia-outsources-its-oil-reserve-problem-to-the-us.

to complement its refineries' products. In 2018–19, Singapore (27 percent), the Republic of South Korea (21 percent), Japan (16 percent), and China (11 percent) were the four largest suppliers, representing a combined 75 percent of total Australian refined products import.[160] Yet, according to the *Liquified Fuel Security Review-Interim Report 2019*, the first three contributing countries do not have their own resources' feedstocks, which means these countries are net crude oil importers that are primarily or over 80 percent dependent on the Middle East region as their provider.[161] These countries are known as service-producing countries whereby they import crude oil, refine it, and sell the finished products to get income. Similarly, the Observatory of Economic Complexity's (OEC) official website also presented data that, in 2018, Singapore (76 percent),[162] Japan (88 percent),[163] and South Korea (70 percent) relied on the Middle East oil supply.[164] This data has shown that the Middle East indirectly contributes 64 percent of Australian imported refined petroleum products or 39 percent of total Australian refined petroleum products consumption. Incorporating the Middle East crude oil supply that directly supplies Australian refineries and indirectly supplies the contributors to Australia's refined products, the Middle East region contributes to nearly 50 percent of all Australian petroleum products consumed.

SLOCs for the Australian petroleum supply vary by time of delivery, which will affect Australia's oil security differently in case of a supply disruption (see Figure 7).[165] Australia's oil business is based on the market system, which means the market handles and adjusts oil resilience. Market-based system principles always want to get profit as much as possible. That is why the majority of Australian petroleum resources are derived

[160] Australian Institute of Petroleum, *Downstrean Petroleum*, 5.

[161] Australian Government Department of the Environment and Energy, *Liquid Fuel Security Review: Interim Report*, 21.

[162] "Crude Petroleum in Singapore," Observatory of Economic Complexity, accessed July 28, 2020, https://oec.world/en/profile/bilateral-product/crude-petroleum/reporter/sgp.

[163] "Crude Petroleum in Japan," Observatory of Economic Complexity, accessed July 28, 2020, https://oec.world/en/profile/bilateral-product/crude-petroleum/reporter/jpn.

[164] "Crude Petroleum in South Korea," Observatory of Economic Complexity, accessed July 28, 2020, https://oec.world/en/profile/bilateral-product/crude-petroleum/reporter/kor.

[165] Australian Government Department of the Environment and Energy, *Liquid Fuel Security Review: Interim Report*, 22.

from nearby Australian countries. The suppliers are mostly located in Southeast Asia and the East Asian region. On average, Southeast Asia needs 9–14 days to transport its product to Australia; meanwhile, Australia needs 10–19 days to get petroleum products from the East Asian countries.[166] Both regions give Australia more profits by cutting transportation costs as fewer days are required for transport.

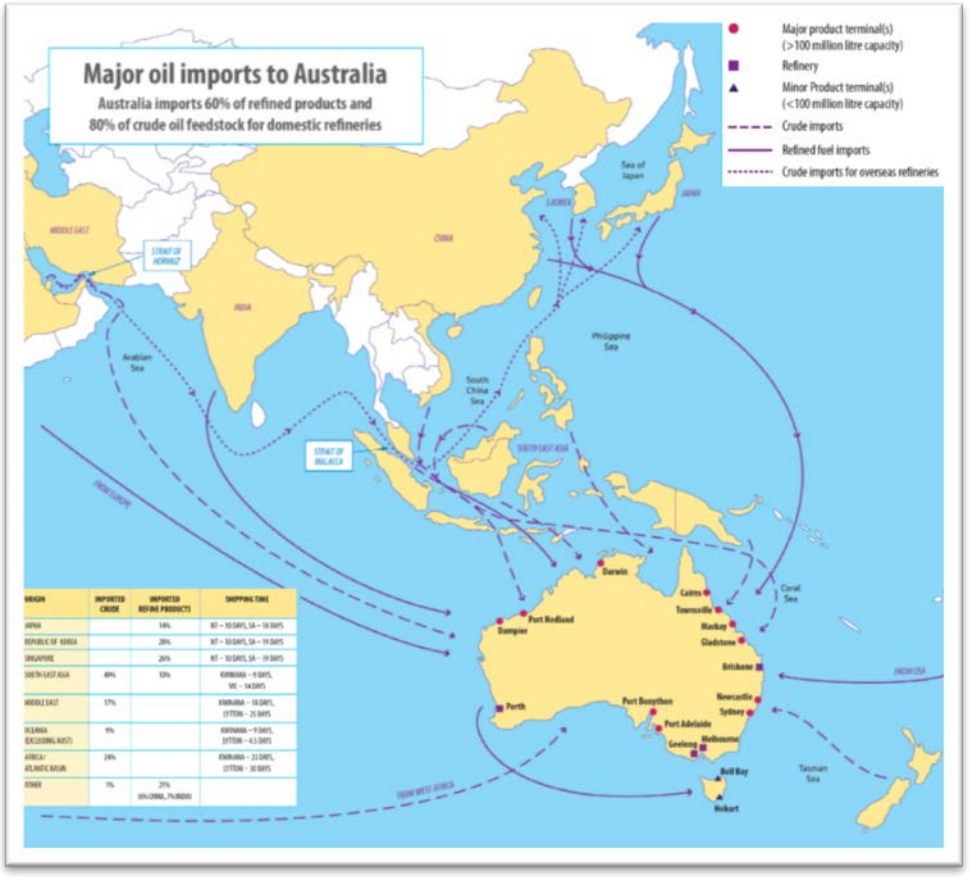

Figure 7. Australian petroleum sea lines of communication (SLOC)[167]

Supported by domestic oil resources and imported oil products, Australia currently has an average oil reserve per type of product of less than one month. Based on the 2020 petroleum statistics report, in 2018–19, Australia had sufficient supplies to cover an

[166] Australian Government Department of the Environment and Energy, 22.

[167] Source: Australian Government Department of the Environment and Energy, 22.

average of 29 days of petroleum consumption, where stock consisted of the following types: crude oil and refineries feedstocks for 27 days, LPG 68 days, automotive gasoline for 23 days, aviation gasoline for 124 days, aviation turbine fuel for 25 days, diesel oil for 20 days, fuel oil for 72 days, lubricating oils for 60 days, and other products for 275 days.[168] The primary petroleum products such as gasoline, diesel, and aviation turbine fuel have 20 days of stock for daily consumption. In 2018–19, Australia only had 55 days of its petroleum stockholding based on the IEA calculation method.[169] This number made Australia the only IEA member that did not meet the IEA obligation to hold 90 days worth of stock. In May 2020, with a small increase, Australia had 59 days of oil in stock.[170]

E. FINDINGS

Given the facts presented in this chapter, it appears that Australia's domestic resources give Australia strong energy reliability, affordability, and resilience in the electricity and gas sector. On the other hand, Australia lacks those characteristics in the oil sector, where the availability of Australian oil at current production levels will be depleted in the next decade. Since no other innovations or policy developments are coming from the Australian government, Australia will be totally dependent on imported fuel oil, both for crude oil refineries' feedstocks and for refined petroleum products. Eventually, its dependence on importing oil products will weaken Australia's energy security, especially its reliability and resilience due to the high risk of oil supply disruption.

Australia has self-sufficiency in meeting energy demands for three of its four primary energy needs supports the survival of the country and enables its citizens to prosper. The need for coal, gas, and renewable energy can be met by Australia's abundant domestic resources, which will remain available for the next several decades. Even these resources can support Australia if there is a surge in demand for electricity. These resources also give Australia a great potential to convert them to alternative fuels. The new

[168] Australian Government Department of Industry, Science, Energy and Resources, *Australian Petroleum Statistics*, 65.

[169] Australian Government Department of Industry, Science, Energy and Resources, 67.

[170] "Oil Stocks of IEA Countries: Measured in Days of Net Imports," International Energy Agency, July 10, 2020, https://www.iea.org/articles/oil-stocks-of-iea-countries.

technologies in advanced machinery and vehicles that use other than oil-based fuel can bolster Australia's energy security.

Meanwhile, Australia has limited oil resources, making Australia dependent on the supply of imported oil products. Domestic oil production only accounts for 10 percent of Australia's oil needs, while the rest comes from abroad. Furthermore, Australia cannot use all of its domestic oil production because the characteristics of Australian oil, which comes primarily from the western part of the country, do not meet the requirements of the country's refineries. Unfortunately, Australia has only a small number of oil resources in the east suitable for refining. Australia now has four refineries that have reached maximum production levels and have been operating since the 1960s. These old refineries can only meet 48 percent of the total consumption of Australian processed products. Over time, as Australian domestic oil approaches total depletion, these refineries will no longerbe as competitive and profitable as some of the new mega refineries in Asia, and by 2030, they will no longer be available. Thus, Australia will be entirely dependent on imported products.

Nowadays, Australia imports 91 percent of its total oil product for domestic consumption, consisting of 81 percent for its crude oil needs and 60 percent for its refined petroleum products demand. This dependency makes Australia very vulnerable to disruptions in its oil supply. Australia does benefit, however, from its strategic location, accessible from two open oceans, namely the Indian Ocean and the Pacific Ocean. Yet, for now, Australia's position is not as advantageous when viewed from the SLOCs that supply Australia's oil needs because those SLOCs have to transit risky choke points. Specifically, Australia's oil SLOC has two precarious choke points, namely the Strait of Hormuz as the gate to Middle East oil suppliers and the Strait of Malacca as the gate to Southeast Asia and South Asia.

The Middle East is known as an unstable region, marked by the uncertainty of its geopolitical situation consisting of the long-lasting tribal conflicts, extremist organizations, rogue regimes, and belligerent actors. Moshe Ya'alon, a former Israeli defense minister who has worked at think tanks on Middle East and strategic studies, argued that, compared

to ISIS and Turkey, Iran was the most dangerous element for Middle East stability.[171] Iran's proxy war strategies and the Iranian hatred and distrust of the United States[172] could drag the region into conflict. Due to its control of the northern Hormuz Strait, Iran's aggressiveness is a serious threat to the international energy supply. The strait is a gateway for tanker traffic carrying 90 percent of the oil from the Persian Gulf.[173] There is a possibility of Iran blocking the strait[174] that influences the flow of oil to the global market so that Iran can gain leverage.[175] According to Caitlin Talmadge, an associate professor at the Edmund A. Walsh School of Foreign Service and a core faculty member of the Security Studies Program who released research in 2008, said an Iranian blockade of the Hormuz Strait would take time for the United States and its allies to resolve: the shortest operation taking 37 days and longest 112 days.[176] To date, Iranian military capabilities are believed to be stronger than they were in 2008, which means that the time for a military campaign to break up the closure of the Hormuz strait would now be even longer than Talmadge predicted.

The closure of the Hormuz Strait threatens Australia's oil security due to supply disruption or delay. The Hormuz's blockage would cause Australia to lose 50 percent of its oil supply, mainly 39 percent of its refined petroleum products supply. Using Talmadge's longest estimated time for a military campaign to open the Hormuz Strait in 112 days, the current Australian stockholding that, on average, has a 20-day supply of refined petroleum products to meet daily consumption, or 55 days' worth of reserves according to the IEA calculation method, would be severely depleted after a month of supply disruption. The delayed supply would be longer than 112 days due to the addition of transit time from the Middle East to Australia. It takes 25 days to transport the oil and

[171] Noa Amouyal, "Stabilizing an Unstable Region," *The Jerusalem Report*, February 5, 2018, 18.

[172] Defense Intelligence Agency, *Iran Military Power: Ensuring Regime Survival and Securing Regional Dominance* (Washington, DC: Defense Intelligence Agency, 2019), 11.

[173] Caitlin Talmadge, "Closing Time: Assessing the Iranian Threat to the Strait of Hormuz," *International Security* 33, no. 1 (2008): 82.

[174] Talmadge, 88.

[175] Talmadge, 88.

[176] Talmadge, 115.

additional time to convert crude oil to refined petroleum products in its contributors' countries. Roughly speaking, if the Hormuz Strait were blocked, Australia would have at least 137 days of delayed oil supply.

Regardless of the geopolitical situation in the Middle East, Australia's current imported oil supply chain is at high risk due to geopolitical uncertainty in the Indo-Pacific region, especially in the South China Sea. As explained in Chapter I, there is a high likelihood of direct conflict in the Indo-Pacific region due to rising tensions between the United States and China. The outbreak of conflict in this area would directly disrupt Australia's imported oil supplies. The main contributors to refined Australian products, namely Singapore, Japan, and South Korea, are located in this region. Roughly speaking, by adding China, the war would disrupt the supply of refined Australian products by 75 percent. Even worse, such a war would also have the possibility of causing Southeast Asian countries to be unable to export 55 percent of their crude oil contribution to Australia. China's military dominance and the location's proximity can threaten and pressure Australia's crude oil suppliers in the region. China has a rational objective in case war happens to stop all logistical supplies to its opponents. Breaking the opponent's logistics line is a common strategy in military operations to win a war. As explained in the previous chapter, Australia, Japan, and South Korea are allies of the United States. Should a conflict occur, there is no doubt that Australia will participate and side with the United States. War in the Indo-Pacific region would cause Australia to lose 67 percent of its total imported oil supply. Therefore, it is important for Australia to find appropriate measures to strengthen its oil security both domestically and by leveraging international cooperation, topics that are discussed in the next chapters.

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III. DOMESTIC AUSTRALIAN OIL DEVELOPMENT PROJECTS AND THEIR CONTRIBUTION TO AUSTRALIA'S OIL SECURITY

As Chapter II explains, Australia is heavily dependent on imported oil supplies that carry a high risk of disruption. Australia's dependence on oil imports has raised concerns among Australian strategic experts over, such possible supply disruptions. In particular, the geopolitical uncertainty in the Indo-Pacific region, where Australia's SLOCs are located, threatens the security of oil supplies that support the Australian economy. The significance of oil in Australia's economic development has propelled the Australian government to strengthen its oil security through several domestic efforts. These internal initiatives aim to increase the country's oil reserves and reduce its oil consumption through the use of technological advances in the transportation sector and the petroleum industry.

This chapter describes the Australian government programs devoted to strengthening Australia's oil security and assesses their potential contributions. First, this chapter offers a general overview of those programs. Second, it describes Australia's development of conventional oil field exploration. Then, it explains the country's projects to increase national oil reserves, including its domestic storage facilities plan. This chapter then examines developments in the Australian government's harnessing of vehicle technology, namely electric vehicles (EV), to decrease its demand for oil in the transportation sector. Next, Australia's emerging unconventional oil development, such as shale oil and tight oil, is explored. Finally, this chapter analyzes these programs' overall contributions to the enhancement of Australia's oil security and argues that in the long term, Australia's oil security will be boosted by EV adoption and shale oil production, while domestic strategic oil reserves and a new refinery will soon make a significant contribution to Australia's oil security.

A. GENERAL OVERVIEW OF AUSTRALIA'S DOMESTIC OIL DEVELOPMENT

Despite its persistent claims that Australia's oil security is strong and reliable, the Australian government has in fact taken some actions that indicate a change in its stance

on oil security. In its several official reports and policies, such as the NESA 2011, the Energy White Paper 2015, the *Liquid Fuel Security Review Interim Report 2018*, and the Department of Industry website, the Australian government, based on historical experience and the market's flexibility in responding to oil supply shocks, strongly claims that Australia has reliable oil security. Nevertheless, as noted in Chapter II, after the closure of some Australian refineries from 2003 to 2015, some strategic experts lost confidence in Australia's oil security. In addition, increasing geopolitical competition in the Indo-Pacific region, especially between Australia's ally, the United States, and China, may be a threat to Australian SLOCs.

The Australian government therefore seeks to increase its oil security by increasing Australia's oil reserves and decreasing its oil consumption. These efforts are its main strategy since, while Australia is still trying to discover new offshore oil fields, there is no new conventional crude oil production to increase the oil supply to its refineries. It appears that the government believes that by decreasing the country's oil demands, Australian indigenous oil and domestic refineries' production will be closer to meeting Australia's oil needs, making Australia's oil security stronger.

Australia's domestic efforts to enhance its oil security mostly involve leveraging innovation and harnessing the latest technology. According to the World Economic Forum 2010, Australia is in the third of Porter's economic development stages, namely the innovation-driven stage.[177] According to Porter, countries in the innovation stage have "the ability to produce innovative products and services at the global technology frontier using the most advanced methods becomes the dominant source of competitive advantage."[178] Advanced technology in the vehicle sector and recent innovation in alternative oil production are Australia's primary means to achieve its oil policy goals, particularly by strengthening its petroleum product reserves. Moreover, according to the Australian

[177] Robert Looney, "Recent Developments on the Rare Earth Front: Evidence of a New Technocratic Mercantilism Emerging in China?," *World Economics* 12, no. 1 (March 2011): 58, http://hdl.handle.net/10945/40895.

[178] Michael E. Porter, *Enhancing the Microeconomic Foundations of Prosperity: The Current Competitiveness Index* (Cambridge, MA: Harvard Business School, 2006), 8, https://www.relooney.com/NS3040/Porter.pdf.

Energy White Paper 2015, EVs will potentially contribute to decreasing the country's oil consumption,[179] along with future fuel oil alternatives such as shale oil, hydrogen, and synthetic fuel.[180] The Australian government therefore seems to be pursuing the solutions stated in its EWP 2015, in addition to its attempts to find new conventional oil projects and thereby increase its oil reserves.

B. CONVENTIONAL OIL EXPLORATION

One of Australia's domestic approaches to increasing its oil security is exploring new conventional oil fields to increase its domestic oil production for its refineries' feedstocks. The exploration of new oil fields is being carried out by the Australian government, but it has not yielded any tangible results. According to the Australian Department of Industry, in 2019, Australia's oil exploration expenditure rose 30 percent, to A$880 million, after a decline in spending since 2013.[181] This rise in exploration spending reflects the Australian government's desire to increase its domestic oil production and its concern about its dependence on oil imports.

Currently, the Australian government has discovered two significant offshore oil fields: the Dorado field in the northwest of Australia and the Great Australian Bight on Australia's southern coast. Nevertheless, those projects are unlikely to strengthen Australia's oil security due to exorbitant production costs and the prospects of its oil quality being unsuitable for the Australian oil refineries' feedstocks.

The Dorado drilling project promises significant production in the future, but its production does not appear to be supportive of domestic refineries' feedstocks to enhance Australia's oil security. According to Adrian Cook, Carnarvon's managing director and CEO, Dorado has potential crude oil resources of 171 million barrels, making it one of the

[179] Australian Government Department of Industry and Science, *Energy White Paper 2015*, 59.

[180] Australian Government Department of Industry and Science, 26.

[181] Sonali Paul, "Australia's Explorers Step up Hunt for Oil after Big Find," Reuters, last modified October 1, 2019, https://www.reuters.com/article/us-australia-oil-idUSKBN1WG2ZM.

largest oil fields found in the North West Shelf.[182] Dorado is predicted to produce oil starting in 2023 and will increase Australian crude oil production.[183] Due to its location in Western Australia, however, there is a high probability that Dorado's oil shares characteristics with oil from other Australian oil basins, such as Carnarvon and Browse basin. As was explained in the previous chapter, the characteristics and quality of Western Australian oil do not meet Australian refineries' requirements; Dorado's oil would be more beneficial to export instead of using it for domestic refineries' feedstocks**.** Therefore, this project ultimately does not enhance Australia's oil security.

Meanwhile, a promising field oil project, the Great Australian Bight, was canceled, leaving Australia missing an opportunity to reduce its dependence on oil imports and thereby enhance its oil security. This project promised 1.5 to 6 billion barrels of oil production,[184] and its oil characteristics and quality could have been appropriate for Australian oil refineries. However, in February 2020, Equinor, the investor company, abandoned this project because of the high cost of drilling underwater and the low price of oil.[185] Instead, Equinor expanded its exploration on Australia's western coast, near the Dorado basin, where it believed more oil reserves and more economic benefits would be found.[186] Equinor's new course of action would increase Australian domestic oil production, but for the same reason as the Dorado project—namely, the quality of the oil—it would not improve Australia's oil security.

[182] "Dorado: One of the Largest Oil Resources Ever Found on the Australian North West Shelf," Energy Global News, August 22, 2018, http://www.energyglobalnews.com/dorado-one-of-the-largest-oil-resources-ever-found-on-the-australian-north-west-shelf/.

[183] "Activity, Projections & Latest Data," Rystad Energy Upstream Analytics Australasia, August 2019, https://www.rystadenergy.com/newsevents/news/newsletters/EandP/upstream-analytics-australasia_Aug-2019/.

[184] "Activity, Projections & Latest Data."

[185] "Equinor and the Great Australian Bight: Questions and Answers," Equinor, February 25, 2020, https://www.equinor.com/en/where-we-are/gabproject-faq.html.

[186] "The Great Australian Bight."

Due to the current low oil price, Australia has had difficulty getting investors for future oil projects. The investment issue was predicted in the Australia EWP 2015, which stated that the price of oil would influence oil exploration and development investment in Australia.[187] In particular, the EWP explained that the low oil prices, experienced since 2014, could hinder oil investor companies from putting their capital into the exploration of the new oil basin in Australia. These trends will likely continue amid the current situation of low oil prices and the recent establishment of competitive mega refineries in Asia.[188] Australia is thus unlikely to have any suitable new crude oil production projects to support Australian refineries and therefore Australia's oil security in the near future.

C. STRATEGIC PETROLEUM RESERVES

Apart from looking for new conventional oil exploration fields, Australia has also worked to increase its strategic oil reserves to improve its oil resilience in the face of oil supply disruptions. Since 1979, Australia has been a member of the IEA, which means Australia participates in collective actions with other IEA members to respond effectively to major oil disruptions.[189] Its membership obliges Australia to have in its reserves a minimum of 90 days of its previous year's net oil import. Yet, according to IEA, since the end of 2010, Australia has never met this number,[190] which indicates its weakness in oil security. This inability to meet the IEA requirement was aggravated by the closure of some Australian refineries between 2012 and 2015. This event triggered the Australian government to adjust its oil reserves to meet IEA compliance, which will automatically strengthen its oil security.

Nevertheless, historically, the Australian government has refused to acknowledge or otherwise remedy the weakness of its oil security. The Australian government has

[187] Australian Government Department of Industry and Science, *Energy White Paper 2015*, 24.

[188] Robins, "BP Refinery Closure Leaves Australia More Reliant on Fuel Imports."

[189] "History From Oil Security to Steering the World Toward Secure and Sustainable Energy Transitions," International Energy Agency, accessed April 6, 2020, https://www.iea.org/about.

[190] "Oil Stocks of IEA Countries:"

resisted intervening directly in the oil sector and has left the industry to manage it.[191] This stance has triggered some criticism from Australian strategic experts, especially amidst the geopolitical uncertainty in the Indo-Pacific. They have perceived Australia as having a serious problem that endangers Australia's national interests and have encouraged the government to make significant efforts to assess the situation and make recommendations to overcome it.

As a result, the Australian government has recently started to intervene in enhancing Australia's oil security directly. As oil prices dropped, on May 1, 2020, Minister for Energy and Emission Reduction Angus Taylor issued a new oil security package in order to enhance Australia's oil security.[192] This package shows the alteration of the Australian government's stance toward its oil security.The package highlighted the importance of the national oil reserves, domestic storage, and Australian refineries.[193] According to Taylor's speech in May 2020, "it is time to build our future capacity," and he said that the government would support oil security by issuing a three-part security package consisting of implementing government-owned oil reserves, increasing local storage, and ensuring Australia's refineries continue to produce petroleum products.[194]

The first part of the package, which aims to increase Australia's oil reserves, was an affirmation of the government action taken a month earlier. On April 22, 2020, the Australian government, through the energy department, announced that Australia had bought crude oil from the United States for A$94 million, a purchase here included the cost for transport and an initial period of ten years' storage of the oil in the U.S. Strategic

[191] Australian Government Department of the Environment and Energy, *Liquid Fuel Security Review: Interim Report*, 41.

[192] John Coyne and Hal Crichton-Standish, "Improving Australia's Fuel Security," *ACAPMAg* (blog), May 13, 2020, https://acapmag.com.au/2020/05/improving-australias-fuel-security/.

[193] "Government Priorities: Australia's Future Fuel Security Package," Australian Government Department of Industry, Science, Energy and Resources, accessed July 6, 2020, https://www.energy.gov.au/government-priorities/energy-security/australias-future-fuel-security-package.

[194] Angus Taylor, "We Will Deliver Energy Security," The Hon. Angus Taylor MP, Minister for Energy and Emissions Reduction, last modified May 2020), https://www.minister.industry.gov.au/ministers/taylor/opinion-piece/we-will-deliver-energy-security.

Petroleum Reserve (SPR).[195] This purchase was an immediate and medium-term objective of Australia's oil policy and was the result of the Australian-U.S. Strategic Partnership on Energy in Indo-Pacific. This partnership is discussed in Chapter IV.

In the second and third parts of the oil security package, the Australian government emphasized building up domestic industries to provide oil reserves and maintain its domestic oil supply for long-term oil security objectives. The domestic private sector's importance to enhancing oil security has encouraged the Australian government to involve local industries in building Australian domestic storage capacity and sustaining domestic refineries. Minister Taylor said: "The government wants to assess how we can best partner with industry to increase our storage capacity to further enhance our onshore fuel security."[196] This statement reflected the Australian government's awareness that increase domestic storage will support Australia's oil supply in time to respond to a supply shock without any delay time for transport, and it eliminates the vulnerabilities of its sea supply chain posed by the first part of the oil security package. The request for information (RFI) regarding the importance of domestic storage was open to the public through July 15, 2020, and the announcement of the next step will be released at the end of 2020.[197]

Australia has excellent opportunities to increase its storage capacity by utilizing its existing private storage facilities, in addition to completing the postponed the East Arm project. According to Australia Strategic Policy Institute (ASPI) researchers John Coyne and Hal Crichton-Standish, Australia's bulk oil storage facilities are already available and underused, such as Marine services company NT Port and Marine's facility on Melville Island, which offers 30 million liters of tank storage capacity.[198] Furthermore, they explain

[195] "Government Priorities: International Energy Agency (IEA)," Australian Government Department of Industry, Science, Energy and Resources, accessed July 9, 2020, https://www.energy.gov.au/government-priorities/international-activity/international-energy-agency-iea.

[196] Angus Taylor, "Enhancing Australia's Fuel Security," The Hon. Angus Taylor MP, Minister for Energy and Emissions Reduction, last modified June 15, 2020), https://www.minister.industry.gov.au/ministers/taylor/media-releases/enhancing-australias-fuel-security.

[197] Australian Government Department of Industry, Science, Energy and Resources, "Government Priorities: Australia's Future Fuel Security Package."

[198] John Coyne and Hal Crichton-Standish, "Australia Must Fast-Track New Domestic Storage to Ensure Fuel Security," *The Strategist* (blog), May 7, 2020, https://www.aspistrategist.org.au/australia-must-fast-track-new-domestic-storage-to-ensure-fuel-security/.

that the new focus of government oil policy could materialize the East Arm's pending project near Darwin, which offers 94 million liters of storage. With all these facilities, the Australian government would spend less money than it would on building new facilities.

Australia will likely have a domestic fuel reserve storage facility soon. On September 14, 2020, the Australian government invested A$211 million to enhance its oil security by building new fuel storage, creating a minimum stockholding policy, and supporting domestic oil industries.[199] The Australian government did not clearly explain whether the new fuel storage facility will utilize an existing facility or be a genuinely new storage facility. Almost all of the funding, namely A$200 million, was allocated to build new diesel storage with a capacity of 780 million barrels. According to Minister Taylor, the construction of diesel storage will secure Australia's diesel supplies, which almost all Australians are reliant on for their economic needs. The government's initiative could encourage local industries to participate in this project.

Australian refineries are the last focus of the three-part oil security package. The Australian government realizes that Australian refineries face more challenges after the decline in production of domestic oil. To secure its refineries in support of Australia's oil security, the government will implement a temporary policy to change standard oil requirements to help refineries diminish storage pressure and allow them to keep the production pace.[200] The government, however, seeks a long-term policy to keep its refineries in production. The government is therefore boosting the progress of unconventional oil production in Australia to supply crude oil feedstock to Australia's refineries. These unconventional oil resources are further discussed in the next section.

[199] Angus Taylor, "Boosting Australia's Fuel Security," The Hon. Angus Taylor MP, Minister for Energy and Emissions Reduction, last modified September 14, 2020, https://www.minister.industry.gov.au/ministers/taylor/media-releases/boosting-australias-fuel-security.

[200] Taylor, "We Will Deliver Energy Security."

Australia will also have a promising new refinery to bolster its oil security in a short time, namely the Darwin Clean Fuel refinery.[201] This new refinery is expected to provide 100,000 barrels of refined products per day. Unlike other Australian refineries, the Darwin Clean Fuel refinery will convert the domestic production of condensate currently used for commodity export. Australian oil production has long been dominated by condensate, which made up 64 percent of total production in 2018–19,[202] during which time Australia produced 250,000 barrels per day.[203] By 2030, Australia is forecasted to produce more than 300,000 barrels of condensate per day.[204] According to Tony Debenham, managing director of Darwin Clean Fuel, "Australia currently consumes in excess of 1,000,000 barrels of transport fuels per day and imports 600,000 barrels per day to meet its transport fuel needs."[205] He further said that the Darwin refinery, which will be operational in 2023, will contribute to significantly bolstering Australia's fuel security and will also provide domestic fuel reserves of 1.1 million barrels of refined products. This refinery will be a major contributor to improving Australia's oil security in the near future.

Overall, the Australian government's oil security package will significantly improve Australia's oil security in the near term. The Australian government is likely to materialize Australia's strategic oil reserves soon, which could provide a temporary emergency supply of oil in the event of an oil supply disruption. Meanwhile, Darwin refinery offers double advantages in bolstering Australia's oil security by reducing Australia's imported oil and providing an oil reserve facility.

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[201] Monica Gameng, "$1.2bn Clean Fuels Processing Plant in NT to Create over 400 Jobs," *Plant Miner* (blog), November 2, 2019, https://blog.plantminer.com.au/1.2bn-clean-fuels-processing-plant-in-nt-to-create-over-400-jobs.

[202] Australian Government Department of Industry, Science, Energy and Resources, *Australian Petroleum Statistics*, 6.

[203] Coyne and Crichton-Standish, "Australia Must Fast-Track New Domestic Storage to Ensure Fuel Security."

[204] "Contractor Selected to Build $1.2B Fuel Refinery," Inside Construction, November 1, 2019, https://www.insideconstruction.com.au/section/contracts-tenders/contractor-selected-to-build-1-2b-fuel-refinery/.

[205] "Contractor Selected to Build $1.2B Fuel Refinery."

D. ELECTRIC VEHICLE DEVELOPMENT

In addition to exploring conventional oil and increasing strategic oil reserves, the use of EVs in Australia could significantly help to address Australia's oil security issues by reducing its dependence on imported oil. Australia's current high dependence on imported oil makes it particularly vulnerable to disruptions to its fuel oil supply. Given that the transport sector constituted 75 percent of Australia's total oil consumption in 2019, by blending the use of internal combustion engine (ICE) cars with electric vehicles for transport, Australia could reduce its oil consumption.[206] EVs entirely powered by Australia's reliable electricity production would reduce the country's reliance on foreign oil and so increase its oil security. According to a ClimateWorks Australia 2016 report, the increase of EV adoption in Australia would bolster the number of fuel stock days "from 18 to 21 days in 2030 and 16 to 20 days in 2050," which means Australia's dependence on imported oil "would decrease 16 percentage points in 2030 and 28 percentage points in 2050."[207] Similarly, on July 25, 2018, in its submission to the Federal Senate Inquiry into Electric Vehicles, Australian Electric Vehicle Association Inc. argued that one million EVs in Australia could directly save A$500 million in fuel costs and replace up to A$15 billion of fuel imports per year, which eventually could enhance the protection of Australia's oil security against disruption.[208]

Through the Australian Renewable Energy Agency (ARENA), the Australian government defines EVs as "cars or other vehicles with motors that are powered by

[206] *Liquid Fuel Security Review Interim Report* (Canberra, ACT: Australian Government Department of the Environment and Energy, April 2019), 9, https://www.environment.gov.au/system/files/consultations/7cf6f8e2-fef0-479e-b2dd-3c1d87efb637/files/liquid-fuel-security-review-interim-report.pdf.

[207] ClimateWorks Australia, *The Path Forward for Electric Vehicles in Australia: Stakeholders Recommendations* (Melbourne, Australia: ClimateWorks Australia, 2016), 5, https://www.climateworksaustralia.org/wp-content/uploads/2019/11/the_path_forward_for_electric_vehicles_in_australia_-_submission_to_the_federal_government_vehicle_emissions_discussion_paper_1.pdf.

[208] Australian Electric Vehicle Association Incorporated Victorian Branch, *Submission to the Federal Senate Inquiry into Electric Vehicles* (Victoria, Australia: Australian Electric Vehicle Association Incorporated Victorian Branch, 2018).

electricity rather than liquid fuels."[209] ARENA further divides electric vehicles into four types, namely battery electric vehicles (BEV), plug-in hybrid electric vehicles (PHEV), fuel cell electric vehicles (FCEV), and non-plug-in hybrid electric vehicles (HEV). At the same time, the Select Committee on Electric Vehicles and the Australian Department of Environment and Energy assert that EVs encompass BEVs, PHEVs, and FCEVs.[210] Therefore, these three types of EV are the most likely candidates for strengthening Australia's oil security.

1. BEVs and PHEVs

To date, the adoption of electric vehicles in the Australian transport sector has been slow, and EVs currently occupy only a small share of the overall sector, but EV infrastructure development and beneficial policy by government and private industry are encouraging EV use to grow rapidly soon. Based on electric car sales up to June 2020, EVs make up a 0.2 percent share of the Australian total vehicle armada, making Australia one of the lowest in EV ownership in the Organization for Economic Cooperation and Development (OECD) countries.[211] On the other hand, the EV statistics further show that Australia's EV sales have increased significantly to 0.6 percent of all vehicles sold in 2019, which were all BEV and PHEV (see Figure 8).[212] This number is expected to continue to increase as the price of electric cars declines and the number of charging stations increases. According to Infrastructure Australia, by 2040, EVs are expected to account for 70 percent to 100 percent of new vehicle sales and at least 30 percent of the vehicle fleet in Australia."[213]

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[209] "What Are Electric Vehicles?," Australian Government Australian Renewable Energy Agency, accessed August 12, 2020, https://arena.gov.au/renewable-energy/electric-vehicles/.

[210] Senate Select Committee on Electric Vehicles, *The Senate Select Committee on Electric Vehicles Report* (Canberra, ACT: The Senate Printing Unit, Parliament House, 2019), 4.

[211] "Electric Car Sales 2020," Budget Direct, June 2020, https://www.budgetdirect.com.au/car-insurance/research/electric-car-sales-australia.html.

[212] "Electric Car Sales 2020."

[213] "National Electric Vehicle Fast-Charging Network," Australian Government Infrastructure Australia, February 14, 2019, https://www.infrastructureaustralia.gov.au/map/national-electric-vehicle-fast-charging-network.

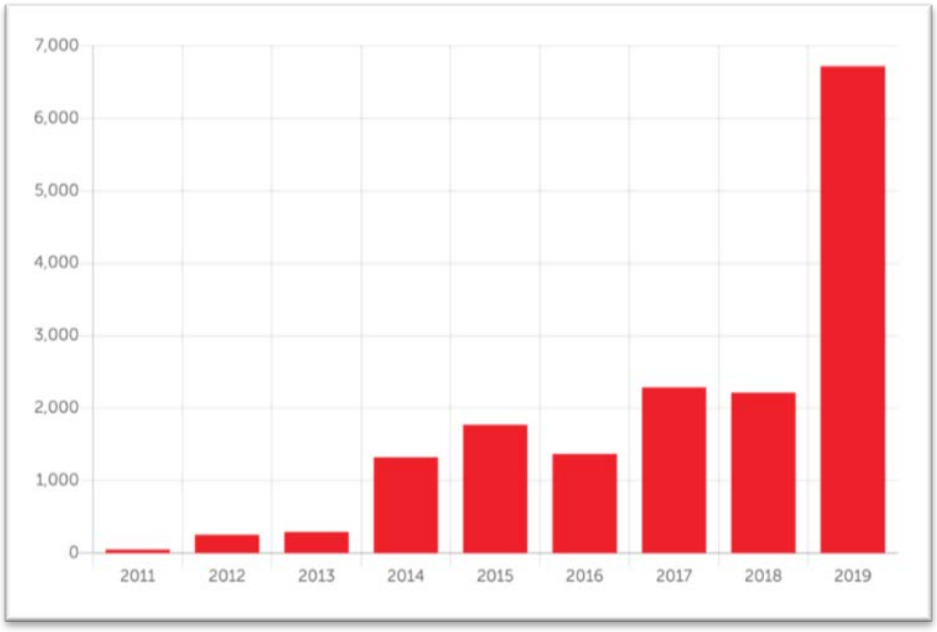

Figure 8. Number of EVs sold in Australia[214]

One factor encouraging the rapid growth in EV adoption is the increasingly affordable price of EVs compared to ICE cars. According to Bloomberg New Energy Finance, price parity between EV and ICE cars will be reached sometime between 2024 and 2040, depending on its segment.[215] Bloomberg also predicted that the share of EVs in Australia's vehicle sales will increase from six percent in 2025 to 28 percent in 2030, and to 60 percent in 2040.[216] In 2040, it is predicted that Australia will house 10 million EVs, or 40 percent of the total Australian vehicle fleet, assuming that EVs reach price parity with ICE cars.[217]

The Australian government's intervention in the form of policy setting and funding is another factor that could encourage Australian's adoption EVs. In May 2018, Energeia

[214] Source: "Electric Car Sales 2020."

[215] Ali Asghar, *Summary of Major Trends in the Electric Vehicle Industry: Evidence to the Senate Select Committee on Electric Vehicles* (Sydney, Australia: Bloomberg New Energy Finance, 2018), https://www.aph.gov.au/DocumentStore.ashx?id=475a0d5a-6c37-4792-a919-4712bd0e198e&subId=659097.

[216] Asghar, 17.

[217] Asghar, 18.

provided a report on the *Australian Electric Vehicle Market Study* for ARENA and Clean Energy Finance Corporation (CEFC) that forecasted Australian EV numbers with three scenarios: a no intervention scenario, a moderate intervention scenario, and an accelerated intervention scenario.[218] Energeia forecasted that, without any intervention from the Australian government, development of Australian EVs sales would be higher than Bloomberg's prediction, reaching 22 percent of vehicle sales in 2030 and 73 percent in 2040. Meanwhile, with moderate government intervention, Australia's EV yearly sales would make up 49 percent in 2030 and 100 percent in 2040. Energeia's last scenario, accelerated government intervention, predicted EVs' yearly sales percentage to be 64 percent in 2030 and 100 percent in 2040.

The adoption of electric vehicles has received serious attention from the Australian Parliament, which gave the Australian government recommendations to accelerate the use of EVs to strengthen Australia's oil security. On June 27, 2018, the Australian Senate formed a Select Committee on Electric Vehicles to investigate electric vehicle prospects, profit opportunities, and existing challenges and recommended measures to overcome these hurdles.[219] After conducting comprehensive inquiries, on January 30, 2019, the committee released a report, *The Senate Select Committee on Electric Vehicles Report 2019*,[220] which contained 17 recommendations to accelerate EV adoption in Australia.[221] In the report, the committee concluded that Australia had lagged behind comparable countries in EV development.[222] The committee further explained that the lack of a robust national policy and strategy was the main point of weakness of the Australian government with respect to EVs, alongside other factors, such as higher starting prices for EVs, consumers' concerns over EV range coverage, lack of recharging infrastructure, and

[218] Energeia, *Australian Electric Vehicle Market Study* (Sydney, Australia: Energeia, 2018), https://arena.gov.au/assets/2018/06/australian-ev-market-study-report.pdf.

[219] Senate Select Committee on Electric Vehicles, *The Senate Select Committee on Electric Vehicles Report*, 1.

[220] "Select Committee on Electric Vehicles," Parliament of Australia, accessed August 12, 2020, https://www.aph.gov.au/select_electric_vehicles.

[221] Senate Select Committee on Electric Vehicles, *The Senate Select Committee on Electric Vehicles Report*, xv.

[222] Senate Select Committee on Electric Vehicles, xv.

available EV model choices. The main recommendations, according to the report, were for the government to initiate a national EV strategy, to pioneer the use of EVs, and to build an integrated EV charging infrastructure throughout Australia involving federal, state, and local governments.

The Australian government responded positively to the committee's recommendation by developing a national EV strategy and executing several projects to accelerate EV adoption. The term "Australian national EV strategy" was officially introduced in the Australian Government Climate Solution Package in May 2019.[223] Melissa Price, federal environment minister, confirmed that the Australian national EV strategy would be released in the mid-2020s.[224] Currently, through ARENA, the Australian government funds several projects to eliminate the barriers that prevent people from switching from ICE cars to EVs. ARENA has been involved in and has co-funded several projects from 2018 to present, such as the Chargefox EV Charging Network Project in 2018 for A$6 million.[225] In 2019, ARENA gave A$15 million for National Ultrafast EV Charging Infrastructure Network to provide at least 42 charging sites along the Australian east coast highways.[226] In early 2020, ARENA funded A$5.3 million for three projects: the Origin Energy Electric Vehicles Smart Charging Trial, the Realising Electric Vehicle-to-Grid Services, and the Energy Freedom Solar Electric Vehicle.[227] Most of these projects aim to increase the public charging infrastructure across Australia and familiarize Australians with EVs.

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[223] Australian Government, *Climate Solutions Package* (Canberra, ACT: Australian Government, 2019), https://www.environment.gov.au/system/files/resources/bb29bc9f-8b96-4b10-84a0-46b7d36d5b8e/files/climate-solutions-package.pdf.

[224] Bridie Schmidt, "Coalition Says No Plans for Electric Vehicle Strategy Until Mid-2020," The Driven, last modified March 26, 2019, https://thedriven.io/2019/03/26/coalition-says-no-plans-for-electric-vehicle-strategy-until-mid-2020/.

[225] "Chargefox Electric Vehicle Charging Network Project," Australian Government Australian Renewable Energy Agency, accessed August 14, 2020, https://arena.gov.au/projects/chargefox-electric-vehicle-charging-network-project/.

[226] "National Ultrafast EV Charging Infrastructure Network," Australian Government Australian Renewable Energy Agency, accessed August 14, 2020, https://arena.gov.au/projects/national-ultrafast-ev-charging-infrastructure-network/.

[227] "Electric Vehicles," Australian Government Australian Renewable Energy Agency, accessed November 5, 2020, https://arena.gov.au/renewable-energy/electric-vehicles/.

The Australian government continues to accelerate the EV adoption by prioritizing the availability of EV charging stations nationwide. In February 2020, Infrastructure Australia, the nation's independent infrastructure advisor, released the 2020 Priority List document, which identified national electric vehicle fast-charging networks as one of six of Australia's highest priorities over the next five years.[228] Based on the list, the Australian government acknowledged that two-thirds of Australian motorists claim that the lack of charging stations was the core barrier to EV adoption.[229] The government has responded by building charging stations. In early 2020, across the government and private sectors, Australia had approximately 2,000 charging stations widely dispersed across the continent.[230] This number was an increase of more than 100 percent compared to 2018, when there were only 783.[231] By building integrated charging stations nationally, concerns about EV driving range limitations can be eliminated and Australia's EV adoption can be stepped up.

Meanwhile, some Australian state governments have separately released their own EV policies to boost EV adoption in their area of responsibility. For instance, the Australian Capital Territory (ACT) government set the goal to decarbonize its vehicle fleet to 100 percent electricity and achieve zero-emission by 2045.[232] The ACT government has taken the lead in the use of EVs for its vehicle fleet. ACT Climate Minister Shane Rattenbury said that the "newly leased vehicles for [the] government fleet [will] be 50% by 2020 and 100 % by 2021."[233] Furthermore, he stated that the ACT local government also has given incentives to EV buyers, "including zero stamp duty and 20% discount on registration for zero emission vehicles." He continued by arguing that, due to local government policy

[228] Australian Government Infrastructure Australia, *Infrastructure Priority List Project and Initiative Summaries* (Canberra, ACT: Australian Government Infrastructure Australia, 2020), 64, https://www.infrastructureaustralia.gov.au/sites/default/files/2020-02/2020%20Infrastructure%20Priority%20List%20LOW%20resolution.pdf.

[229] Australian Government Infrastructure Australia, 76.

[230] Australian Government Infrastructure Australia, 76.

[231] "Select Committee on Electric Vehicles," 14.

[232] Bridie Schmidt, "Act Finalises Shift to 100 Per Cent Renewables, Now Eyes Transition to Electric Vehicles," The Driven, last modified August 27, 2019, https://thedriven.io/2019/08/27/act-govt-leads-way-transition-electric-vehicles/.

[233] Schmidt.

limitations, the federal government had to engage in supporting the state governments. The role of the federal government would significantly boost EV adoption in Australia. Another state government is Queensland, which has released "The Future is Electric" as its EV strategy.[234]

2. FCEVs (Hydrogen Fuel)

Like BEV and PHEV, hydrogen FCEV is another promising alternative for the future Australian vehicle fleet to enhance Australia's oil security by reducing its oil consumption. Australia is currently entering the initial phase in deploying FCEVs. The main encouraging factor in FCEV development is the ambitious goal of the Australian government with respect to hydrogen fuel. On November 22, 2019, the Australian federal government launched Australia's National Hydrogen Strategy, which stated that Australia aims to be a top global hydrogen exporter by 2030 and to set "a path to build Australia's hydrogen industry."[235] While focusing on hydrogen as an export commodity, this strategy also declared the government's interest in hydrogen vehicles by stating that "one of the most exciting prospects for hydrogen is the transport sector–Australia's largest end user of energy."[236] Compared to BEVs, hydrogen vehicles have more energy, cover longer distances, and are faster to refuel; and for those reasons, through its national hydrogen strategy of 2019, the Australian government supported hydrogen vehicles as "a cost-competitive fuel option for Australian land and marine transport, in particular for heavy-duty and long-range transport applications"[237] to enhance Australia's fuel security.

Australia's hydrogen goal can likely be achieved due to its abundant resources for producing hydrogen. Based on the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in the Australian National Hydrogen Roadmap report, hydrogen can

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[234] Senate Select Committee on Electric Vehicles, *The Senate Select Committee on Electric Vehicles Report*, 9.

[235] COAG Energy Council Hydrogen Working Group and Energy Council, *Australia's National Hydrogen Strategy* (Canberra, ACT: Commonwealth of Australia, 2019), 71, https://www.industry.gov.au/sites/default/files/2019-11/australias-national-hydrogen-strategy.pdf.

[236] COAG Energy Council Hydrogen Working Group and Energy Council, 45.

[237] COAG Energy Council Hydrogen Working Group and Energy Council, 80.

be produced in two ways: through a thermochemical or electrochemical process.[238] CSIRO explains that with carbon capture and storage, the thermochemical method uses natural gas through the steam methane reforming (SMR) process and coal through the gasification process; meanwhile, the electrochemical method uses electricity to produce hydrogen through the electrolysis process. As described in Chapter II of this thesis, Australia has abundant natural gas and coal resources, which will remain available for several decades and can support Australia's industry in producing hydrogen. Similarly, due to Australia's strategic location, renewable sources for electricity generation to power the electrochemical method are also very abundant in the Australian continent. The Australian government claimed that Australia is the leading country in harnessing solar energy and one of the top countries for wind resources.[239] According to Geoscience Australia, 11 percent of the Australian continent is appropriate for producing clean hydrogen, of which three percent is highly suitable[240] and sufficient for the predicted global hydrogen demand in 2050 of 230 million tons.[241]

The Australian government has spent significantly to boost hydrogen projects. Since 2018, the federal government has spent A$147 million and, on May 4, 2020, announced an additional A$300 million to be managed by Clean Energy Finance Corporation (CEFC).[242] Meanwhile, ARENA has separately funded several hydrogen projects since 2018. Between 2018 and June of 2020, ARENA invested over A$55 million in hydrogen studies and demonstration projects.[243] Furthermore, on July 20, 2020, ARENA

[238] S. Bruce et al., *National Hydrogen Roadmap: Pathways to an Economically Sustainable Hydrogen Industry in Australia* (Canberra, ACT: Commonwealth Scientific and Industrial Research Organisation (CSIRO), 2018), https://www.csiro.au/en/Do-business/Futures/Reports/Energy-and-Resources/Hydrogen-Roadmap.

[239] COAG Energy Council Hydrogen Working Group and Energy Council, *Australia's National Hydrogen Strategy*, 10.

[240] COAG Energy Council Hydrogen Working Group and Energy Council, 10.

[241] COAG Energy Council Hydrogen Working Group and Energy Council, 22.

[242] Natalie Filatoff, "New Hydrogen Fund: Can We Get Bang from 300 Million Bucks?," *PV Magazine*, last modified May 4, 2020, https://www.pv-magazine-australia.com/2020/05/04/new-hydrogen-fund-can-we-get-bang-from-300-million-bucks/.

[243] "Seven Hydrogen Projects Vie for $70 Million in Funding," ArenaWire, July 20, 2020, https://arena.gov.au/blog/seven-hydrogen-projects-vie-for-70-million-in-funding/.

announced that it will invest A$70 million in accelerating the renewable hydrogen development for seven projects that will operate in 2022.

The Australian government's seriousness about hydrogen development, in both funding and policy, has attracted much investment in hydrogen production projects. Several industries are starting to invest in solar-power hydrogen facilities, such as Austrom Hydrogen for 3.6 GW, BP Australia for 1.5 GW, Siemens for 5 GW, and Asian Renewable Energy Hub (AREH) for 15 GW.[244] Kawasaki Heavy Industries agreed to build a hydrogen energy supply chain (HESC) pilot project that will be the first and biggest international liquid hydrogen supply chain.[245] It will produce hydrogen from brown coal to export to Japan by 2030. Infinite Blue Energy (IBE) has committed A$300 million to execute the Arrowsmith project to build a set of hydrogen facilities in Western Australia.[246] The IBE explained further that the project is to be powered by wind and solar, producing 25 tons of hydrogen per day, and that first production is expected by late 2022.

In parallel with the development of the hydrogen industry and in accordance with its National Hydrogen Strategy, the Australian government has started supporting and incorporating hydrogen vehicles in its vehicle fleet. The ACT government is the first state government to use hydrogen vehicles in its vehicle fleet. In May 2019, 20 Hyundai NEXO hydrogen FCEVs were announced as part of the ACT vehicle fleet, with the first public hydrogen station operating in December 2019.[247] Victoria made a similar effort to implement the hydrogen vehicles in its territory. Funded by ARENA and Toyota for a total cost of A$7.4 million, by late 2019, Victoria had a hydrogen center and 13 Toyota Mirai

[244] Marija Maisch, "New 3.6 GW PV-Powered Hydrogen Project Announced in Australia," *PV Magazine*, last modified June 10, 2020, 6, https://www.pv-magazine.com/2020/06/10/new-3-6-gw-pv-powered-hydrogen-project-announced-in-australia/.

[245] Marija Maisch, "Morrison Government Paves the Way for Brown Hydrogen Industry," *PV Magazine*, last modified May 15, 2020, https://www.pv-magazine-australia.com/2020/05/15/morrison-government-paves-the-way-for-brown-hydrogen-industry/.

[246] Michael Mazengarb, "Massive Hydrogen Project Gets Green Light After Securing $300m Investment," Renew Economy, last modified April 29, 2020, https://reneweconomy.com.au/massive-hydrogen-project-gets-green-light-after-securing-300m-investment-68959/.

[247] "Australia's First Public Hydrogen Refueling Station Confirmed," Carsales, May 9, 2019, https://www.carsales.com.au/editorial/details/australias-first-public-hydrogen-refueling-station-confirmed-118373/.

FCEVs, and it will have operational hydrogen electrolyzer and refueling stations by late 2020.[248] The adoption of FCEVs in the government vehicle fleet will continue to accelerate the growth of the FCEV as an alternative means of transportation in Australia.

Australia's significant hydrogen development, specifically the government's use of FCEVs, has attracted a local car manufacturer, called H2X Australia, to offer a hydrogen FCEV option for the Australian people[249] and has encouraged the state government to build hydrogen fueling stations. H2X plans to produce a hydrogen SUV called Snowy in 2022 and other hydrogen FECVs, including tractors and trains. Some projects that are funded by the Australian government through ARENA and the hydrogen industry are also building hydrogen refueling stations. ARENA funded a hydrogen project in Sydney for A$15 million.[250] Furthermore, ARENA-funded hydrogen refueling stations in Queensland will be operational by mid-2020,[251] and private industries Infinite Blue Energy and NewVolt, are participating in providing hydrogen fueling stations and EV fast-charging stations that will be operational in 2023 for 17 stations on Eastern Australia highways.[252] The various option of FCEV in Australia and support infrastructure are other factors that encourage the FCEV growth in Australia, which would significantly increase Australia's oil security.

E. SHALE OIL

The Australian government's last domestic approach to increasing its oil security is to utilize Australian shale oil resources; Australia has significant shale oil resources widespread in several basins across the continent that could support its domestic oil demand. According to Geoscience Australia, most of the undiscovered potential unconventional oil fields are located in four main oil basins, namely the Cooper Basin, the

[248] Mike Costello, "Toyota Australia Announces Multi-Million Dollar Hydrogen Filling Station at Altona," Caradvice, last modified March 19, 2019, https://www.caradvice.com.au/737127/toyota-australia-announces-multi-million-dollar-hydrogen-filling-station-at-altona/.

[249] Bridie Schmidt, "H2X Hopes to Re-Boot Australia Car Industry with Launch of Hydrogen SUV," The Driven, last modified June 12, 2020, https://thedriven.io/2020/06/12/h2x-hopes-to-re-boot-australia-car-industry-with-launch-of-hydrogen-suv/.

[250] COAG Energy Council Hydrogen Working Group and Energy Council, *Australia's National Hydrogen Strategy*, xix.

[251] COAG Energy Council Hydrogen Working Group and Energy Council, xxiii.

[252] Mazengarb, "Massive Hydrogen Project Gets Green Light After Securing $300m Investment."

Canning Basin, the Perth Basin, and the Georgina Basin (see Figure 9).[253] In total, Geoscience Australia, the data from which is accurate up to August 2018, stated that Australia's unconventional oil resources were 1,534,939 million barrels.[254] Nonetheless, historically, shale oil production in Queensland did not provide significant output.[255] Yet, with the success of U.S. shale oil production since 2014,[256] the Australian government has been encouraged to develop Australian shale oil production to lessen the country's dependence on imported oil, including reviewing its moratorium on fracking methods for extracting shale resources.

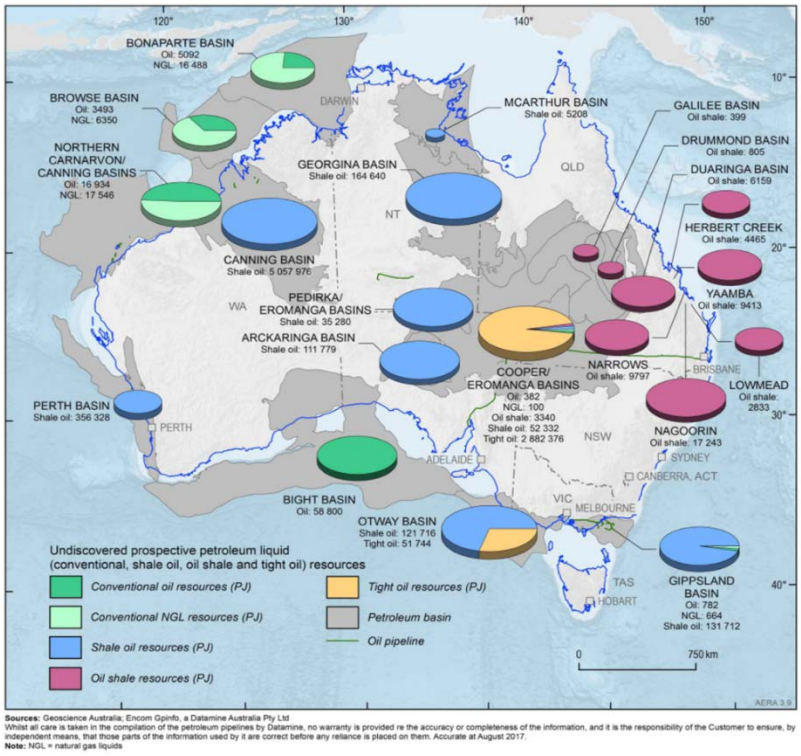

Figure 9. Australian unconventional oil resources[257]

[253] Australian Government Geoscience Australia, "Australian Energy Resources Assessment: Oil."

[254] Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia, *Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia: Final Report to the Western Australian Government* (Perth, Western Australia: Western Australia Government, 2018), 106–7, https://frackinginquiry.wa.gov.au/sites/default/files/final_report.pdf.

[255] Australian Government Geoscience Australia, "Australian Energy Resources Assessment: Oil."

[256] Kimberly Amadeo, "Behind the U.S. Shale Oil Boom and Bust," The Balance, last modified May 1, 2020, https://www.thebalance.com/us-shale-oil-boom-and-bust-3305553.

[257] Source: Australian Government Geoscience Australia, "Australian Energy Resources Assessment: Oil."

The Australian government has now therefore approved the hydraulic-fracturing or fracking method to extract Australia's unconventional resources, especially shale gas and shale oil. Supported by a report provided by CSIRO's Gas Industry Social and Environmental Research Alliance (GISERA) that stated fracking has little to no impact on the environment, the Northern Territory government lifted its fracking moratorium in April 2018.[258] Similarly, after conducting an independent inquiry into hydraulic fracture stimulation for one year and projecting a low impact on people and the environment,[259] in November 2018, the Western Australia government announced its revocation of the fracking ban.[260] Even though the fracturing area is limited, it covers most of the areas where shale resources are available. Since then, some oil and gas companies, such as Black Mountain[261] and Theia Energy,[262] have started to invest in big shale projects, especially in the basins containing gas reserves and liquid petroleum and condensate, such as the Georgina Basin in Northern Australia and the Canning Basin in Western Australia.

Australian shale oil production has entered the exploration stage and could be operational soon. As of late 2019, there were projects executed in the Canning Basin and the Beetaloo Basin.[263] While the Beetaloo Basin will mainly be exploited for shale gas production, there were indications that this project would further extract shale oil. Minister Taylor said in May 2020 that "the government is focused on opening up the Beetaloo Basin

[258] Tom Westbrook, "Australia's Northern Territory Lifts Fracking Ban," Reuters, last modified April 16, 2018, https://www.reuters.com/article/us-australia-gas-idUSKBN1HN360.

[259] Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia, *Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia,* 48.

[260] Eliza Laschon and Rhiannon Shine, "WA Fracking Ban Lifted, but Different Rules for North and South Keep Some Areas 'Frack Free,'" ABC News, last modified November 27, 2018, https://www.abc.net.au/news/2018-11-27/wa-fracking-ban-lifted-but-perth-peel-south-west-frack-free/10558892.

[261] Brian Balboa, "Australia Presents Opportunity for E&P Companies Looking Beyond U.S. Unconventionals," Journal of Petroleum Technology, last modified July 22, 2020, https://pubs.spe.org/en/jpt/jpt-article-detail/?art=7378.

[262] Ben Collins, "Major Fracking Project Proposed in West Kimberley to Extract up to 57 Billion Barrels of Oil," ABC News, last modified August 11, 2019, https://www.abc.net.au/news/2019-08-12/multi-billion-dollar-oil-project-using-fracking-west-kimberley/11389046.

[263] "Shale Oil Development in Australia," Lock the Gate Alliance, January 29, 2020, https://www.lockthegate.org.au/shale_oil_development_in_australia2.

in the Northern territory"[264] in order to support local refineries. Meanwhile, the Canning Basin will mainly produce shale oil. Theia Energy, as the operator of the Great Sandy Desert project in the Canning Basin, is expected to produce up to 100,000 barrels oil per day of the six billion recoverable-oil from the likely tens of billions of shale oil resources.[265] This project would require a A$77 billion investment and would be the biggest oil-producing project in Australia.[266]

The Great Sandy Desert project is waiting for the approval of the land's indigenous owner to become operational. The chairman of the Karajarri traditional lands association, Thomas King, said that the project would bring huge benefits to the local people and "will probably end up being the biggest oil project in Australia."[267] His statement implies that he will likely be a proponent of this project. With the necessary approval, the Great Sandy Desert project could produce shale oil in a matter of months. According to the Western Australian government in its final inquiry report of 2018, "the time required to drill and hydraulically fracture a single well can range from 13–60 days."[268] Theia Energy acknowledged the drilling cost challenges, which are several times higher than those in the United States, but Theia Energy's chief operating officer, Jop van Hattum, said that the other factors "could tip the balance in favour of the project."[269] Once approval has been granted, shale oil would make a significant contribution to Australia's oil security in the near future as it can supply the crude oil for Australian refineries.

F. FINDINGS

The Australian government has changed its position from leaving Australian oil affairs entirely to the market to taking a direct role in strengthening Australia's oil security. The oil packages reflect the Australian government's changing point of view about the

[264] Taylor, "We Will Deliver Energy Security."

[265] Collins, "Major Fracking Project Proposed."

[266] Collins.

[267] Collins.

[268] Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia, *Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia*, 135.

[269] Collins, "Major Fracking Project Proposed."

country's required level of oil security. The Australian government's previous claims that it has highly reliable oil security has changed to taking an active approach to protect against supply disruptions. It also has shown the new approach of the Australian government to intervene in the oil sector directly. National security interests have overtaken other factors that previously were prone to be merely economic interests. The national reserves projects in particular demonstrate the government's seriousness about bolstering and protecting the country's oil supply in case of disruption. Even though the effectiveness of purchasing A$94 million from American oil reserves is questioned by Australian strategic experts, its purchase gives critical impetus to build Australian domestic storage. The current Australian government's huge investment and determination will very likely attract oil industries to participate and commence domestic fuel storage projects in the near future.

A promising unconventional oil discovery, the Dorado project, and its future production will very likely make no contribution to strengthening Australia's oil security. The Dorado oil from offshore Western Australia probably cannot match the characteristics and quality of current Australian refineries' feedstocks. Similar to the existing Western Australia oil production, if no upgrades are made to the Australian refineries, the quality and characteristics of the Dorado oil would not be suitable for domestic refineries. The Dorado oil would not therefore help in strengthening Australia's oil security, but would provide benefits as an export commodity.

On the otherhand, Australia will have significant input to strengthening its oil security with the Darwin Clean Fuel condensate refinery. By producing 100,000 barrels of refined products per day, the Darwin refinery, which will be operational in 2023, will reduce Australia's import of refined products by 17 percent. Calculating from Australia's average use of one million barrels of refined products per day, the Darwin refinery will contribute ten percent of Australia's total oil consumption. This project assists long-term objectives for Australia's oil security due to the development of natural gas production that automatically increases condensate production as its byproduct.

The development of EVs will also gradually support Australia's oil security by reducing Australia's oil needs for transportation. Based on the 2018–19 Australian Energy Updates report, the transportation sector accounted for 75 percent of Australia's total oil

consumption, of which road transportation makes up 75 percent. The increases in EV adoption are intended to substitute for ICE: in 2040, EVs are predicted to constitute 40 percent of all the vehicles on Australia's roads. This means EVs will reduce total oil consumption by 22.5 percent. While waiting for the federal government to release the national EV strategy, state governments' efforts will likely increase Australian EV adoption, following Energeia's second scenario prediction model, namely moderate intervention. This scenario predicts that EVs will offer significant contributions from 2030 onward. EVs still need a decade to support Australia's oil security significantly, or maybe less than a decade with the federal government's accelerated intervention. With abundant resources for electricity plants and hydrogen production, the government has an opportunity to enact further policy that encourages people to shift from ICE vehicles to electric vehicles.

Finally, Australia will have shale oil production soon due to the ongoing project that was started at the end of 2019. Shale oil production from the Canning Basin could increase the crude oil feedstocks for Australian refineries, which could maintain the operation of domestic refineries. The Canning Basin's shale oil production will also avoid the FGEnergy forecast that Australia will close two more refineries by 2027.[270] There is no further information about the quality of the Canning Basin shale oil, but based on Minister Taylor's statement, it could be suitable for Australian refineries. The short time needed for production, only 60 days, will give Australia the opportunity to boost its production and reduce its dependence on oil imports.

In conclusion, Australia will have an additional critical contribution to strengthen its oil security from the new Darwin Clean Fuel condensate refinery and its domestic oil reserves project. Australia's oil reserves in the United States provide a small amount of additional stockholding required by the IEA but will not help Australia in time in the event that Australia experiences oil supply disruption. Meanwhile, shale oil production has to be accelerated by obvious federal government policies. In the long term, the use of EVs offers an essential contribution to enhance Australia's oil security in the next decade.

[270] Coyne and Crichton-Standish, "Improving Australia's Fuel Security."

IV. AUSTRALIAN INTERNATIONAL ENERGY POLICY AND ITS CONTRIBUTION TO NATIONAL OIL SECURITY

In addition to its domestic efforts, Australia's dependence on imported-oil supplies has encouraged the government to take international measures to increase its oil security. Although Australia imports oil from over 50 countries as described in Chapter II, the country remains far from secure due to its over-reliance on the Middle East and SLOCs that go through the South China Sea. Instead of balancing its supply input among regions or diversifying its oil supply from more countries, Australia has attempted to increase its oil security by establishing a strategic energy partnership with the United States and has taken a significant step toward resolving its maritime border issues with Timor-Leste, which could provide other gas and oil resources.

Nevertheless, as illustrated in this chapter, these two efforts, as well as some others, to strengthen its oil security are weak attempts at securing its supplies. This chapter first describes the inefficient strategic energy partnership between the United States and Australia in the Indo-Pacific region. Next, it discusses the new treaty between Australia and Timor-Leste resolving their maritime border, a treaty that is designed to pave the way for the Greater Sunrise oil and gas field exploitation project; however, some uncertainties in this project do not guarantee its contribution to Australia's oil security.

A. AUSTRALIA–U.S. STRATEGIC ENERGY PARTNERSHIP IN THE INDO-PACIFIC

Australia and the United States have cooperated since World War I, and this cooperation is likely to continue in various sectors, including their energy partnership. The advantages conferred by this historical cooperation encourage the two states to maintain their cooperation.[271] In addition, as described in Chapter I, the rise of China that has caused geopolitical insecurity and instability in the Indo-Pacific region also adds an impetus for furthering this partnership. Both countries perceive that China's aggressive behaviors

[271] Trump, *National Security Strategy of the United States of America*, 61.

threaten their national interests and require them to forge strategic partnerships in the security and economic fields, including the energy sector.

China's behavior in the Indo-Pacific region thus underpinned the establishment of the Australia-U.S. strategic partnership, which sought to uphold the rules-based international order and maintain regional stability. The United States 2017 National Security Strategy stated that "China is using economic inducements and penalties, influence operations, and implied military threats to persuade other states to heed its political aspirations," all of which endanger trade flow and threaten other states' sovereignty, creating instability in the region.[272] Similarly, the Australian 2017 Foreign Policy White Paper acknowledged the threats posed by China's influence in the Indo-Pacific region, stating that "China will seek to influence the region to suit its own interest" by using its economic superiority to achieve strategic ends.[273] Therefore, Australia and the United States are cooperating to guarantee free trade and economic fairness in the region based on the rules-based international order: On February 23, 2018, the two countries formed the Australia-U.S. Strategic Partnership on Energy in Indo-Pacific. The White House announced that the strategic partnership's objectives align with the United States' and Australia's strategic foreign policies, promoting "regional infrastructure and energy cooperation, open and competitive energy markets, and improved rules and standards in the Indo-Pacific."[274]

The establishment of the Australia-U.S. energy partnership also implicitly aims to restrain China's economic influence in the Indo-Pacific region by preventing more Indo-Pacific countries from falling into China's debt–trap economic strategy. According to Commander of the USINDOPACOM Admiral Philips' statement in the *Department of Defense Indo-Pacific Startegy Report 2019*, "Beijing is leveraging its economic instrument of power in ways that can undermine the autonomy of countries across the region ... easy money in the short term, but these funds come with strings attached: unsustainable debt,

[272] Trump, 46.

[273] Turnbull, *2017 Foreign Policy White Paper*, 26.

[274] "Joint Press Release by the United States of America and Australia," White House, February 23, 2018, https://www.whitehouse.gov/briefings-statements/joint-press-release-united-states-america-australia/.

decreased transparency, restrictions on market economies, and the potential loss of control of natural resources."[275] China's economic development program, called the Belt and Road Initiative (BRI), has ensnared some countries to cede their strategic assets, such as ports, due to their inability to pay their debts. Therefore, the Australia-U.S. energy partnership also offers an alternative source of funding for Indo-Pacific countries seeking to develop their infrastructures.

Following the establishment of their strategic energy partnership, Australia and the United States committed themselves to strengthening and expanding their partnership through an annual energy security dialogue. Both countries then discussed this partnership during the Australia-U.S. Ministerial Consultation on July 24, 2018, broadening the partnership to encompass Indo-Pacific and global energy security.[276] Then, on October 2, 2018, Australia and the United States held their first energy security dialogue.[277] The U.S. Department of State reported that the dialogue produced a memorandum of understanding (MoU) intended "to enhance the existing framework for bilateral cooperation and strengthen areas of mutual interest in the energy sector."[278] In addition, the MoU also stated that the partnership aims to facilitate bilateral energy trade and investment, which is important for Australia's oil security.

The Australia-U.S. strategic partnership thus offers Australia an opportunity to strengthen its oil security by supplying oil products to Australia and investing in Australia's domestic oil projects. Through this partnership, coordination among Australia and U.S. energy actors becomes stronger and more intense. Eventually, the partnership gives Australia access to the U.S. SPR as a way to increase Australia's oil reserves to protect against oil supply disruption. Minister Taylor said that "Australia has been negotiating access to the SPR since 2018," which referred to the Australia-U.S. strategic partnership

[275] U.S. Department of Defense, *The Department of Defense Indo-Pacific Strategy Report*, 9.

[276] "Fact Sheet: 2018 Australia-U.S. Ministerial Consultations," U.S. Embassy & Consulates in Australia, July 24, 2018, https://au.usembassy.gov/fact-sheet-2018-australia-u-s-ministerial-consultations/.

[277] "First Annual U.S.-Australia Energy Security Dialogue," U. S. Department of State, October 2, 2018, https://www.state.gov/first-annual-u-s-australia-energy-security-dialogue/.

[278] United States Department of State.

on energy.[279] He further stated that after being granted access to lease the U.S. SPR in the previous month, on April 22, 2020, Australia committed A$94 million to buy U.S. oil and store it in the U.S. SPR. On June 3, 2020, U.S. Secretary of Energy Dan Brouillette and Australia's Minister of Energy and Emissions Reduction Angus Taylor signed the official lease agreement through a virtual ceremony.[280] In his speech afterward, Mr. Taylor said that this agreement was integral to sustaining Australia's fuel security and increasing its resilience against world oil shocks.[281] He further said that this agreement would "contribute to Australia's IEA compliance and strengthen our security."[282]

Nevertheless, Australia's purchase of American oil does not directly improve Australia's oil security because it would arrive too late in supplying oil to Australia in the event of an oil supply disruption resulting from conflict in the Indo-Pacific region. Some Australian strategic experts have criticized this purchase due to the storage location being outside of Australia. For instance, according to Chistian Downie, an Australian research council DECRA Fellow from the Australian National University, the purchase of American oil "will do little to bolster our energy security given the oil reserves will remain on the other side of the Pacific."[283] Obtaining this oil would require at least 35 days' shipping from the United States before it can be processed in Australia.[284] The processing time to convert the crude oil to the refined product would further delay the oil's availability to the Australian people. The combined shipping and processing time will exceed Australia's 29

[279] Angus Taylor, "Australia to Boost Fuel Security and Establish National Oil Reserve," The Hon. Angus Taylor MP, Minister for Energy and Emissions Reduction, last modified April 22, 2020, https://www.minister.industry.gov.au/ministers/taylor/media-releases/australia-boost-fuel-security-and-establish-national-oil-reserve.

[280] U.S. Department of Energy. "U.S. and Australia Sign Historic SPR Deal," Energy.gov, last modified June 3, 2020, https://www.energy.gov/articles/us-and-australia-sign-historic-spr-deal.

[281] Angus Taylor, "Remarks at Signing of US-Australia Strategic Petroleum Reserve Lease Agreement - Parliament House, Canberra," The Hon. Angus Taylor MP, Minister for Energy and Emissions Reduction, last modified June 3, 2020, https://www.minister.industry.gov.au/ministers/taylor/transcripts/remarks-signing-us-australia-strategic-petroleum-reserve-lease.

[282] Taylor.

[283] Christian Downie, "Taking U.S. Oil in a Global Crisis Sounds Good on Paper, but It Won't Do Much for Australia's Energy Security," The Conversation, last modified March 11, 2020, http://theconversation.com/taking-us-oil-in-a-global-crisis-sounds-good-on-paper-but-it-wont-do-much-for-australias-energy-security-133344.

[284] Coyne and Crichton-Standish, "Improving Australia's Fuel Security."

days of available daily reserve stock of refined petroleum products.[285] If there is a disruption of Australia's oil supplies because of a conflict, these oil reserves will not help Australia immediately or in time to supply oil.

In addition, the purchase of American oil does not improve Australia's oil resilience against oil supply disruption in that it does not add to the diversification of Australia's imported oil suppliers. Australia's stored oil in the U.S. SPR only functions as a temporary aid when Australia experiences oil supply constraints but does not regularly supply Australia as does imported oil, which is used daily by the Australian people. Australia's imported oil supplies mostly remain reliant on the Middle East and Southeast Asia, which are at high risk in the event of direct conflict between the United States and China.

The purchase of American crude oil is a starting point for the Australian government's action to strengthen its oil security while meeting the IEA requirement to hold 90 days of its previous year's net oil import. Dr. Graeme Bethune, an economic and financial analyst, argued that the Australian government has made significant progress in the right direction for strengthening its oil security.[286] He explained further that at the price of $22 per barrel, Australia actually bought 4.2 million barrels, which is four to five days' worth of crude oil for Australian oil consumption. At current production levels, Australian refineries can convert 4.2 million barrels of crude oil as raw material over ten days into refined products needed by the Australian public.[287] Even though the oil reserves location is very far away from Australia, this action shows Australia's commitment to fulfilling the requirement set by the IEA.[288]

While the Australian-U.S. Strategic Partnership does not itself contribute directly to improving Australia's oil security, it was the catalyst for Australia's domestic measures in the realm of oil development. Shortly after its purchase of American oil, amidst the

[285] Australian Government Department of Industry, Science, Energy and Resources, *Australian Petroleum Statistics*, 65.

[286] Michael Doyle, "Australia Boosts Oil Reserves, but How Many Barrels Does $94 Million Get?," ABC News, last modified April 23, 2020, https://www.abc.net.au/news/2020-04-24/explainer3a-australia27s-oil-purchase/12177060.

[287] Mushalik, "Australia Outsources Its Oil Reserve Problem to the US."

[288] Coyne and Crichton-Standish, "Improving Australia's Fuel Security."

criticism of this approach, Australia issued its new oil security policy. Australia has since started building up its domestic reserves and encouraging its local industries' role in enhancing its oil security. As described in Chapter III, the Australian government is committed to funding A$211 million to build domestic oil reserves, creating a minimum stock-holding policy, and supporting local oil industries.[289]

B. THE GREATER SUNRISE, A PROJECT OF AUSTRALIA–TIMOR-LESTE JOINT PETROLEUM DEVELOPMENT AREA

In addition to the Australia-U.S. strategic partnership, through the new treaty of the Greater Sunrise oil and gas field with Timor-Leste, Australia has also sought to open up an opportunity to strengthen its oil security while exemplifying its commitment to abiding by the rules-based international order. China's aggressive behaviors in the Indo-Pacific region that challenge the existing rules-based international order encouraged Australia to call on all the region's countries to maintain international order and to emphasize peaceful settlements for all conflicts and disputes. Australia too showed its commitment to abide the international order by resolving its long-lasting maritime border dispute with Timor-Leste under the UN mechanism: on March 6, 2018, Australia made a significant decision by signing the new treaty concerning its maritime border with Timor-Leste, ratified in July 2019.[290] In March 2018, the Australian Department of Foreign Affairs and Trade stated: "As Australia identified in its 2017 Foreign Policy White Paper, the treaty is a testament to the way in which international law reinforces stability and allows countries to resolve disputes peacefully. It is an example of the rules-based order in action."[291]

Australia now has an opportunity to strengthen its oil security via a joint petroleum development area with Timor-Leste, namely, the Greater Sunrise offshore gas and oil field, which would provide a new source of petroleum product imports. The new Australia–Timor-Leste treaty paves the way to exploit the Greater Sunrise oil and gas resources, a

[289] Taylor, "Boosting Australia's Fuel Security."

[290] Fitch Solutions, *Australia Oil & Gas Report: Includes 10-Year Forecasts to 2028* (London: Fitch Solutions Group Ltd, 2019), 8.

[291] "Australia and Timor-Leste Maritime Boundaries" (Australian Government Department of Foreign Affairs and Trade, March 2018), https://www.dfat.gov.au/sites/default/files/fact-sheet-headline.pdf.

project that had been long held up due to the maritime border dispute between them. Greater Sunrise holds 226 million barrels of condensate and 5.1 trillion cubic feet of gas, the commercialization of which would be worth $50 billion.[292] Under the treaty, Greater Sunrise offers Australia 20 to 30 percent of its total revenue, depending on the processing facility's location.[293] If the processing facility is in Timor-Leste, Australia will have a new secure and cheap source of imported petroleum products. Due to Australia's proximity to Timor-Leste, Australia will be able to cut shipping costs and eliminate its oil SLOC threats.

To develop its country and maximize the exploitation of the Greater Sunrise oil and gas field, the Timor-Leste government has indeed preferred to have onshore processing facilities in its country rather than in Australia, which enhances the prospects offered by Greater Sunrise to strengthen Australia's oil security. Timor-Leste acknowledges that it will face a critical challenge once the Bayu Undaan oil and gas project, the largest contributor to Timor-Leste's revenue, ceases in 2022.[294] The Timor-Leste government therefore envisioned a comprehensive objective of the Greater Sunrise field in its Strategic Development Plan 2011–2030, which is "to transition Timor-Leste from a low income to upper middle income country by 2030" and proposes the Tasi Mane Project plan as the primary way to achieve it.[295] The Tasi Mane project is an integrated project, which consists of the petroleum Suai Supply Base, the Betano refinery, and the Beaco LNG plant. The Timor-Leste government expects that this project could boost GDP growth, create many jobs, and establish the national petroleum industry.

The government of Timor-Leste has made significant efforts to commercialize the Greater Sunrise oil and gas field project but it remains unclear when the field will be operational due to disagreement among stakeholders. To realize the Tasi Mane project, in 2018, the Timor-Leste government, through its national oil company, TimorGap, bought

[292] Fitch Solutions, *East Timor Oil & Gas Report: Includes 10-Year Forecast to 2028* (London: Fitch Solutions Group Ltd, 2019), 12.

[293] Bartolomej Tomić, "Timor-Leste, Australia Resolve Border Issues. Pave Way for Sunrise Development," *Offshore Energy* (blog), August 30, 2019, https://www.offshore-energy.biz/timor-leste-australia-resolve-border-issues-pave-way-for-sunrise-development/.

[294] Tomić.

[295] Fitch Solutions, *East Timor Oil & Gas Report: Includes 10-Year Forecast to 2028*, 16.

out the share of Tasi Mane owned by ConocoPhillips and Shell for $684 million, which made Timor-Leste the primary stakeholder of the Greater Sunrise field with a 56.6 percent share.[296] After removing two opponents of the Tasi Mane project, Timor-Leste now faces Australia's Woodside Petroleum, which is the only hurdle to starting the project. However, in 2019, Woodside Petroleum announced its support for the plan, but only for funding the offshore project.[297] Another important move from the Timor-Leste government was signing a contract with China Railway Construction to build LNG plant facilities for $943 million.[298] While Woodside predicted that the project would be online after 2027, TimorGap Chief Executive Francisco Monteiro forecasted that the project would be in the market between 2025 and 2026.[299]

In addition to the business issues, the currently changing political dynamics in Timor-Leste are likely to delay or cancel the Tasi Mane project, which also delays or cancels the availability of oil products from this project to Australia. In July 2020, the Timor-Leste government removed the key persons in the energy sector from the old regime under Xanana Gusmao, the proponent of the Tasi Mane project.[300] The new minister for petroleum and mining, Victor Soares, stated that the current government has a new strategic outlook for the petroleum sector and needed to change the leadership of the national oil company, TimorGap, to align with it.[301] This statement signaled the uncertainty of the continuation of the Tasi Mane project. Damon Evans from Energy Voice argued that even if this project goes on, it will begin after 2030.[302] Furthermore, he noted that some industry observers predicted that this project would be canceled for reasons of negative economic

[296] Fitch Solutions, 12.

[297] Fitch Solutions, *Australia Oil & Gas Report: Includes 10-Year Forecasts to 2028*, 10.

[298] Fitch Solutions, *East Timor Oil & Gas Report: Includes 10-Year Forecast to 2028*, 8.

[299] Sonali Paul, "UPDATE 1-E.Timor's State Oil Company Sees Greater Sunrise Producing Gas around 2026," *Reuters*, last modified June 19, 2019, https://www.reuters.com/article/timor-lng-idUSL4N23Q18O.

[300] Damon Evans, "Sunset at East Timor's Greater Sunrise LNG after Woodside Write-Down," *Energy Voice* (blog), July 22, 2020, https://www.energyvoice.com/oilandgas/asia/254153/sunset-at-east-timors-greater-sunrise-lng-after-woodside-write-down/.

[301] Evans.

[302] Evans.

impact, which is zero profit, and that the Greater Sunrise oil and gas will be processed in Darwin after 2030. The project would only provide Australia with unnecessary additional condensate production feedstock for the Australian Darwin Clean Fuel condensate refinery. As described in Chapter III, the new Darwin Fuel clean condensate refinery, which is expected to be operational in 2023, has enough supply from current Australia condensate production. Therefore, the prospect that the Tasi Mane project will provide cheap and secure petroleum product for Australia is uncertain or worse, will no longer be available.

C. FINDINGS

Australia's engagement in international politics to secure its oil supply is a response to China's rise in the Indo-Pacific. China's aggressive behaviors threaten Australia's national interests, especially its energy supply routes. Therefore, the Australian government has emphasized the importance of maintaining the Indo-Pacific region's stability by upholding the rules-based international order and creating cooperation. For these purposes, while maintaining regional stability through security cooperation with the United States, Australia also established a strategic partnership with the United States in the energy sector. Similarly, Australia saw the opportunity to enhance its oil security by resolving its maritime dispute with Timor-Leste, which at the same time showed its commitment to uphold international law under the UN.

On the other hand, the Australia–U.S. Strategic Partnership on Energy in the Indo-Pacific does not help Australia's oil security directly. The partnership does contribute to increasing Australia's compliance with the IEA minimum stockholding obligation and has triggered the enhancement of new domestic oil reserves and the domestic industry's role in the energy sector. But the partnership does not diversify Australia's imported-oil suppliers or reduce Australia's dependence on the Middle East or Southeast Asian countries' oil. The high risk of Australia's oil supply disruption should there be a direct conflict between the United States and China in the region remains the same, namely very high. The partnership only increases the amount of Australian IEA stockholding by storing Australia's reserves in the U.S. strategic petroleum reserves. Those reserves will be useless,

however, if Australia experiences oil supply disruption because they will not arrive in Australia in time to supply oil.

Meanwhile, the Greater Sunrise oil and gas field exploitation project scenarios make uncertain contributions to Australia's oil security. In the case of the first scenario, which involves the continuation of Tasi Mane project, it will provide Australia a secure and cheap imported-petroleum product supply. Once the Tasi Mane project is operational, especially the Betano refinery, Australia will simultaneously have two advantages: a shared revenue stream and a new supplier of refined oil products. Australia's very close proximity to Timor-Leste will reduce threats to the SLOCs for its oil supply. With these resources in place, conflict in the Indo-Pacific region, especially on the South China Sea, will not likely affect Australia's oil supply routes. The Timor-Leste refinery will also offer cheaper refined petroleum products due to reduced transportation costs. Yet, the Tasi Mane project will not begin for at least a decade and will take even longer to produce petroleum products. The current political situation in Timor-Leste exacerbates the uncertainty of this project development.

Finally, in the second scenario, as predicted by many energy sector experts, if Darwin processes the Greater Sunrise oil and gas, then Australia will not reap the oil security benefits of condensate production. The Greater Sunrise field's additional condensate production is not required for Darwin refinery feedstocks, which is likely to be exported. Exporting the condensate production will give Australia additional income but will not influence its oil security. Therefore, the second scenario, in which the Greater Sunrise product is processed at the Darwin facility, will not contribute to enhancing Australia's oil security.

In sum, Australia's international efforts to strengthen its oil security through partnerships in the energy sector are promising but are weak responses to an issue. The strategic energy partnership between Australia and the United States is inefficient because it cannot immediately assist Australia if conflict in the Indo-Pacific region were to disrupt its oil supplies. Meanwhile, the uncertainties surrounding the Greater Sunrise field mean that the Tasi Mane project, which could provide Australia a secure and cheap imported oil

sources, is not guaranteed to be operational. Therefore, the country still needs to address such energy insecurities.

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V. CONCLUSION AND RECOMMENDATIONS

This chapter synthesizes the findings of this research and offers recommendations for the Australian government with respect to strengthening its oil security in case of conflict in the Indo-Pacific region. As posited in the third hypothesis, the Australian government plans to reduce domestic oil consumption by utilizing technological advancements in order to improve its energy security. Contrary to the first and second hypotheses, however, Australia is not diversifying its oil exporters and is involving the government in strengthening oil security and building new oil infrastructure. Ultimately, Australia's current preparedness efforts to enhance its oil security do not wholly help the country in the near future, because domestic efforts will not be effective until 2023 at the earliest. Meanwhile, Australia does not have any substitute oil source in the event of disruption. Therefore, in addition to increasing its domestic oil production reserves and also reducing its oil consumption, Australia most importantly needs to diversify its oil sources so that they are more evenly distributed across several supply regions; it needs to especially find suppliers in regions where oil supply lines are not threatened by direct conflict between the United States and China in the Indo-Pacific region. That way, Australia will reduce the risk of losing most of its imported oil supply in the event of a conflict.

A. SYNTHESIS

Apart from oil, Australia's abundant natural resources have long enabled the country to meet its energy needs. Australia has used these resources for domestic consumption and also as export commodities, and these commodities contribute significantly to the Australian GDP. At present, Australia's coal and natural gas are more than sufficient for its domestic electricity and gas consumption. Along with the development of renewable energy and the current rate of electricity generation and export, Australian coal and gas can support the country for the next several decades. The situation is different for Australia's oil resources. Since its peak in 2001–02, Australia's domestic

oil production has declined, and this trend has pushed Australian reliance further toward imported oil, which now makes up 91 percent of its total oil consumption.[303]

Australia's heavy reliance on oil imports undermines its oil security, as there is an imminent danger to its imported oil supply due to increasing tensions between the United States and China that could lead to direct conflict. Historically, the Indo-Pacific region's advantageous geopolitical situation has protected Australia from experiencing significant imported oil supply disruptions. As a result, the Australian government has long believed that its energy industries could address possible disruptions to its oil supply through a market-based approach. Therefore, the Australian government formerly adopted a policy of not intervening in the petroleum sector except in emergencies and as a last resort.

China's rise, however, has increased geopolitical tensions and uncertainty in the Indo-Pacific region, which has affected Australia's perspective about its oil security. Australia is certain to side with the United States in a confrontation with China and may get directly involved if there is an open conflict with China. Because Australia imports most of its oil from the Middle East and Southeast Asia, the country's oil SLOCs will become vulnerable in such an event. Australia's alliance with the United States means that China poses an enormous threat to most of Australia's SLOCs and, therefore, its imported oil supply. As a result, the Australian government has taken a more active role to improve its oil security.

Given these circumstances, this thesis has sought to answer the research questions raised in Chapter I: First, how does Australia try to ensure its oil security, especially with its vulnerability to oil supply disruptions due to uncertain maritime security? This thesis has offered three potential explanations and hypotheses: the Australian government diversifies its oil exporter countries, notably to countries outside areas at risk of conflict; the Australian government will continue to execute a market-based policy that emphasizes economic advantages, which keep its dependency on imported oil, and that keep the government from interfering directly in Australia's oil sector; and the Australian

[303] Australian Government Department of Industry, Science, Energy and Resources, *Australian Petroleum Statistics*, 12.

government reduces domestic oil consumption to improve the country's energy security by utilizing technological developments. The findings of this thesis verify the third hypothesis but are contrary to other two. Although Australia has historically had an uninterrupted supply of imported oil, in the current uncertain geopolitical situation in the Indo-Pacific region, the Australian government has shifted its position on the security of its imported oil supplies from self-confident to self-prepared; it has thus tried to increase its oil security by reducing its heavy reliance on imported fuel sources by intervening directly in building oil infrastructure and utilizing technological advances but has not increased the diversity of its oil suppliers.

Australia's international measures to strengthen its oil security have included establishing strategic energy partnerships and cooperation with the United States and Timor-Leste. Nevertheless, Australia's partnerships do not contribute to the diversification of Australia's oil suppliers, which is in contrast with the first hypothesis. The Australian government continues to believe that its oil suppliers are sufficiently diversified because they are derived from more than 50 countries. Furthermore, contrary to hypothesis two, the Australian government has taken actions, both domestically and internationally, to intervene directly in this sector, using preventive measures to maintain Australia's oil supply. The government no longer will let Australia's energy industries handle Australia's oil security alone. Driven by much criticism from several Australian strategic experts, the Australian government has initiated domestic efforts to increase the country's oil resilience by increasing domestic oil production, developing national oil reserves, setting a minimum stockholding policy, and building storage facilities. In line with hypothesis three, Australia also has tried to reduce its oil consumption by capitalizing on developments in vehicle technology through the use of EVs.

Second, in what ways will Australia's strategic partnerships assist in its quest for improved energy security? This thesis finds that Australia's international cooperation and strategic partnerships do not directly contribute to Australia's oil security. The Australia-U.S. strategic partnership merely enhances Australia's compliance with the IEA's minimum requirements for oil stockholding. This strategic partnership will almost certainly not help Australia respond to oil supply disruptions in the event of conflict in the

Indo-Pacific region because the time it takes to ship the oil exceeds the average duration of oil reserves in Australia. In addition, cooperation between Australia and Timor-Leste in managing oil and gas fields, in particular the Greater Sunrise, is also still far from being realized; if it is realized, it will take more than a decade. The project's questionable utility is compounded by its possible use of the Darwin processing facility, the output of which does nothing to contribute to Australia's oil security.

The findings of this thesis also reveal that only some of the Australian government's domestic efforts significantly enhance its oil security. National oil reserves and a new condensate refinery are likely to increase Australia's oil security in the near term. The national oil reserves projects will improve Australia's resilience against oil supply disruption by increasing the amount of available oil reserves that could be used immediately in the event of supply disruption. Similarly, the new condensate refinery will reduce Australia's imported refined product by 17 percent and will provide petroleum product reserves at the same time.

By contrast, other domestic initiatives, such as conventional oil production, shale oil exploration, and EV adoption will not contribute or will take a long time to make a significant contribution to strengthening Australia's oil resilience. For one, Australia's enormous conventional oil production project of the future, the Dorado project, will not increase Australia's oil security. As described in Chapter II, Dorado oil's characteristics and quality, which are likely to be highly similar to current Western Australian oil, will not be suitable for Australian refineries. In addition, the current Australian shale oil exploration remains in the initial phase, requiring more infrastructure developments and business arrangements by the government to be operational. Furthermore, Australia's ability to self-sustain in producing electricity and hydrogen to power EVs offers huge opportunities in reducing its oil consumption in the long term. Yet, the absence of federal government policy on the Australian adoption of EVs means that EVs' contribution to strengthening Australia's oil security will be felt only after 2030. The Australian state governments' individual efforts are likely to only increase the proportion of electric vehicles in Australia to 40 percent of all vehicles by 2030 and to 100 percent only by 2040. As tensions and uncertainties in the geopolitical situation in the Indo-Pacific increase, two decades is a very

long time in helping improve Australia's oil security in an effort to anticipate the consequences of open conflict in the region.

B. POLICY RECOMMENDATIONS

Given these findings, this thesis proposes the following recommendations. First, the Australian federal government has to accelerate the adoption of EVs by establishing a national EV strategy as soon as possible, which will drastically reduce its domestic oil consumption and thereby increase its oil security. Given its abundant resources to generate electricity and to produce hydrogen, Australia will have no difficulties in powering its EVs, both BEVs and FCEVs. With a comprehensive Australian federal government policy, as Energia forecasts, Australian EV sales are expected to make up 100 percent of Australian car sales by 2030. Once road transportation has switched mostly to EV, Australia will reduce its total oil consumption by 57 percent. Thus, Australian oil consumption will be used primarily for air and maritime transportation, which will steadily increase in the future; this approach also aligns with the current government's plans for a minimum stockholding policy and a diesel storage facility.

Furthermore, regarding Australian domestic oil production, Australia has to be able to utilize its current domestic oil production and the next huge promising oil output from the Dorado project and shale oil. Therefore, Australia needs to upgrade its refineries or build a new refinery that can process Western Australia's oil into refined products for domestic consumption, instead of for export commodity, which does not contribute at all to strengthening Australia's oil security. Similarly, Australia's shale oil exploration also has to be supported by significant Australian government policy. The short time required for shale oil production offers Australia an immediate significant contribution to supply its domestic refineries, which also reduces Australia's dependence on oil imports. Once Australia starts to produce shale oil and combine it with its conventional oil production for its refineries' feedstock, the existing Australian refineries could provide 40 percent of the refined petroleum products for domestic consumption, which also reduces its crude oil imports significantly.

Finally, most important is that Australia reevaluate its belief that its imported oil supplies are secure. Notwithstanding the Australian government's current efforts to improve its oil security, Australia still remains at high risk of experiencing imported oil supply disruption. As Chapter II explained, despite procuring oil from more than 50 countries, if its SLOCS are threatened, Australia is still at risk of losing 67 percent of its total oil imports, amounting to 75 percent of its refined products and 55 percent of its crude oil. In particular, Australia's imported petroleum products are mostly supplied by Singapore, Japan, South Korea, and China. Were the United States and China to go to war, these four main suppliers of Australia's refined products would automatically not be able to export their refined products because China will cut off their oil refinery feedstocks. Therefore, increasing the imported oil supply from regions secure from direct conflict between the United States and China, supported by the increased domestic efforts of the Australian government, is Australia's most important step to enhance its oil security.

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